Amateur Radio

August 1997
Volume 65 No 8

WIRELESS INSTITUTE OF AUSTRALIA

Journal of the Wireless Institute of Australia

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- **Intermodulation Performance and Measurement**
- **Simple Peak-Reading Watt-Meter**
- **A Two Metre X-Beam**

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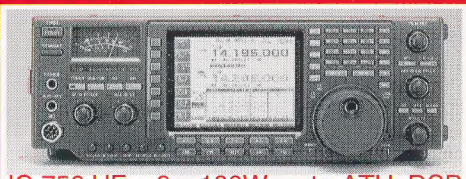

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Cover

August is the month of the Remembrance Day Contest, a contest held to commemorate those radio amateurs who died during World War II. Featured on the front cover this month is a WWII vintage Type 3 Mk II, 3-15 Mcs (MHz), CW only, "spy" transmitter/receiver from the collection of Ron VK3OM. The transmitter sits at the top of the left hand side of the open case, with the receiver below it. In the right hand part of the open case, on the left hand side, is the PSU (which runs from 100-250 V AC and 6 V DC) with, alongside it, the spares compartment (holding spare valves and additional Tx final coils) with the Morse key fastened to the front panel. In the foreground is a set of WWII vintage headphones and Morse key. The background is a WWII poster and QSL cards with a military connection from the WIA Historical QSL Collection, courtesy of the Hon Curator, Ken Matchett VK3TL.

(Photo by Ron Fisher VK3OM)

BACK ISSUES
Available direct from the WIA Federal Office, only until stocks are exhausted, at $4.00 each (including postage within Australia) to members.

PHOTOSTAT COPIES
When back issues are no longer available, photocopies of articles are available to members at $2.50 each (plus $2.00 for each additional issue in which the article appears).

The opinions expressed in this publication do not necessarily reflect the official view of the WIA, and the WIA cannot be held responsible for incorrect information published.

Amateur Radio Service

A radiocommunication service for the purpose of self-training, intercommunication and technical investigation carried out by amateurs, that is, by duly authorised persons interested in radio technique solely with a personal aim and without pecuniary interest.

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Editor's Comment

Road Testing New Rigs

At last month's Publications Committee meeting a comment was made that several months' issues this year have contained no *Equipment Review*. This is not a reflection on the output of our industrious regular reviewer, Ron Fisher VK3OM. It is more in realisation that there is a limit to how much one person can achieve!

Consider the task faced by most of our regular columnists, and even more by your Editor. We acquire facts from various sources and then put together sufficient words to review or discuss the material. Ron has to do that too. But first he has to help in temporarily acquiring from the relevant dealer the equipment to be tested. Then he has to set it up in his home shack and learn to operate it almost instantly! He has to use it in all modes of which it may be capable. He has to connect it to various items of test equipment and, as far as possible, determine how good it is quantitatively and how it compares with other makes and models. Then, and only then, he can start writing.

It is surprising, isn't it, that each year, for decades now, there have been as many as six or seven *Equipment Reviews* by VK3OM? Wouldn't it be good to have one each month? It would be amazing, but it is more than one person can do.

This is not to ignore the various contributors (VKs 2ZIP, 3IY, 3UV, 3WL, 3AFW, 3AUI, and 3DIP)who have also provided reviews over the years. But we need more of them! It would be marvellous if we could achieve a regular *Equipment Review* every month. But Ron would be the first to agree that he's already pushed to the limit and would like "a bit of a rest".

We know from our survey in December 1995 that *Equipment Reviews* are one of the most popular segments of *Amateur Radio*. You would all like to see them more often. So, is there anyone out there who would like to take over a fraction of the work and help spread the effort more widely?

If you would like to help us, we would be delighted to hear from you at vk3br Communications Pty Ltd. You need not be in Melbourne, but it would be logistically preferable.

How about it?

Bill Rice VK3ABP
Editor

CONTRIBUTIONS TO *AMATEUR RADIO*

Amateur Radio is a forum for WIA members' amateur radio technical experiments, experiences, opinions and news. Manuscripts with drawings and/or photos are always welcome and will be considered for possible publication. Articles on computer disk or via e-mail are especially welcome. The WIA cannot assume responsibility for loss or damage to any material. A pamphlet, *"How to Write for Amateur Radio"*, is available from vk3br Communications Pty Ltd on receipt of a stamped, self addressed envelope.

■ WIA News

Roger Harrison VK2ZRH, Federal Media Liaison Officer

New Class Licensed Devices Likely to Affect 430 MHz

The Australian Communications Authority (ACA) has advised the WIA that they will proceed with plans to Class Licence new "low interference potential devices" (LIPDs) using a variety of new frequency band allocations, but of particular concern to amateurs is the new allocation at 433.05-434.79 MHz.

Designated as an "All Transmitters" allocation, which means transmitters using this new allocation could serve a wide variety of applications including, according to the ACA, wireless stereo headphones, motor vehicle radio keys and low powered data transmission systems. Such applications on this frequency range are supported by the self-same allocation in a number of European countries. The specified maximum transmitter output is 25 mW equivalent isotropically radiated power (EIRP).

While low power transmitters operating in this frequency range will be likely to cause interference to amateur FM voice and packet reception under some circumstances, the greater problem for amateurs arises from receivers for these applications being blocked by amateur 70 cm transmissions. This is a potentially severe problem where the receivers are on all the time, such as with "wireless" audio links between a CD or cassette player and the associated amplifier.

Wireless links for audio equipment is a new trend in this consumer product category. Source equipment, such as CD or cassette players, have an in-built transmitter with the amplifier, or stereo tuner-amplifier, having an in-built 433 MHz receiver. Without the trailing audio cables, the equipment does not need to be stacked together, but can be placed anywhere convenient in a room. Also in this category are wireless amplifier-loudspeaker combinations and wireless headphones. European manufacturers such as Philips, Sennheiser, Sony and Vivanco, launched a range of wireless-linked audio products onto the market there last year. However, they ran into problems in some countries (see *WIA News* in *Amateur Radio*, March 1997, page 5). Radio keys using the 433 MHz band caused considerable consternation for car owners as amateur, land mobile and military stations blocked the door lock receivers for considerable distances.

The WIA has twice raised objections with the Spectrum Management Agency to the proposed new allocation in the 70 cm band. First, in reply to a letter from the SMA in December last year (again, *WIA News* in *Amateur Radio*, March 1997, page 5), and second in a formal submission in reply to the SMA's proposal in April this year.

The ACA noted in their Information Package issued in April, which proposed a series of updates to the 1993 Class Licence for LIPDs, that there was *"... a growing interest in this band for low powered applications sourced mainly from Europe ... and related to the long standing designation in that Region, of the band 433.05-434.79 MHz for industrial, scientific and medical (ISM) applications."*

The WIA's response, delivered to the SMA on 2 May, pointed out the likely interference problems from amateur 70 cm operations, even from stations using frequencies well outside the 433.05-434.79 MHz band. The WIA band plan provides for FM simplex and repeater operation, RTTY, SSTV, WICEN and packet radio. The receiver sensitivities in wireless audio equipment, for example, are apparently on the order of 100-500 microvolts per metre. Amateur stations operating between 430 and 440 MHz are capable of causing widespread interference, the WIA warned the SMA.

A modest amateur home station operating packet radio or FM voice in the 433-434 MHz segment, running powers of typically 25-50 watts output to a small gain antenna (typical), would likely cause blocking at distances up to 1 km in a suburban neighbourhood. The receiver bandwidths of 433 MHz wireless audio links are such that sensitivity likely falls off only modestly 5 MHz either side of centre frequency. A 100 watt SSB amateur home station, with a modest Yagi of 10 dB gain could wreak havoc with such wireless systems at distances up to 5-10 km in suburban situations.

With the foreshadowed introduction of the Class Licence permitting use of devices such as wireless audio equipment and radio vehicle keys, the WIA is writing to the Consumer Electronics Suppliers Association and relevant Motor Traders Associations to warn of likely problems should equipment operating on 433.05-434.79 MHz be introduced here, and pointing out alternatives.

The WIA's submission in May to the SMA on the LIPD proposal also raised objections concerning the proliferation of devices on the 13 cm, 6 cm and 1.25 cm amateur bands, particularly where amateur satellite allocations are affected. The lower 50 MHz of the 1.25 cm (24 GHz) band is the first primary amateur band segment above two metres, and is a satellite band.

WIRELESS INSTITUTE OF AUSTRALIA
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International Affairs

from David Wardlaw VK3ADW

Second Report from the Future of the Amateur Service Committee

Changes to simplify and clarify the wording of the International Regulation which defines the Amateur Service have been recommended by the International Amateur Radio Union's (IARU) Future of the Amateur Service Committee (FASC) in its latest report, released in June.

The FASC, chaired by IARU Vice President, Michael Owen VK3KI, released a Discussion Paper in April 1996 to foster debate among the world amateur community about the issue of Article 25 in the International Regulations which defines the Amateur and Amateur-Satellite services, and the issue of retention of testing Morse code proficiency being retained or not as a treaty obligation (see IARU News, *Amateur Radio*, October 1996, page 4).

A first report following circulation of that Discussion Paper was issued in mid-1996, which was considered by the IARU Region 1 Conference in Tel Aviv over late-September, early-October that year. At the time, the FASC proposed to prepare a second report for consideration by the Region 3 Conference, to be held in Beijing next month.

The aim of the IARU is to form a global policy after each Region association has expressed their views. The formulation of that policy will be delegated to the IARU Administrative Council after the Region 2 Conference in 1998, to inform amateur delegations attending the World Radio Conference (WRC-99) in 1999 where the issues raised will be on the conference agenda.

The draft new wording for Article 25, and the accompanying discussion are too lengthy to reproduce here, unfortunately. The FASC's Second Report should appear on the IARU's Web site, at *www.iaru.org* in due course, where the original Discussion Paper and the First Report can also be found. However, copies have already been distributed to Divisions for comment. If you want a copy for your own interest, a request to your Division Federal Councillor or Division Secretary with an A4 SASE or larger should get you one. Comment can be sent to your Federal Councillor, or to IARU FASC, c/o IARU International Secretariat, PO Box 31095, Newington, CT 06131-0905 USA, or by e-mail to *iaru@iaru.org*, subject "To IARU FASC".

Have you advised the SMA of your new address?

Region 3 Conference Preparation

Preparations for the IARU Region 3 Conference in Beijing are well under way, with conference and briefing papers completed, or being prepared, covering amateur examinations in Australia, the WIA's submission to the Government on amateur licensing, EMC and Standards developments and future issues, RF safety and health issues in Australia, recent developments in radiocommunications licensing in Australia, Australian participation in the IARU beacon project, progress in various amateur pursuits in Australia (ARDF, satellites, packet radio, VHF-UHF and microwave, etc), further plans for the "Support for the Amateur Radio Service in Region 3" (STARS***) project, WRC issues, and other matters.

Brisbane Listener Wins May Recruitment Prize

The lucky recruit from May's crop of new WIA members to win the Fluke 12B digital multimeter is a YL from Donnybrook, in Brisbane's north, **Ms T Johnston L40380**, a member of the Redcliffe Radio Club.

There's a multimeter to be won every month throughout 1997 in a draw from among new WIA recruits joining in any particular month. So far, three lucky new members of the NSW Division, one from the Victorian Division and now one from the Queensland Division have been rewarded with this great prize. The Fluke 12B digital multimeter is worth $195, and the 12 prizes have been generously donated by Philips Test and Measurement. Fluke is the world's pre-eminent manufacturer of digital test instruments and the Model 12B is from their latest range of hand-held instruments.

The Fluke 12B measures AC and DC voltage (with auto-selection above 4.5 V), resistance and capacitance from 1000 pF to 1000 µF. The instrument features a simple rotary dial, a 4000-count liquid crystal display, and diode and continuity testing. Its "continuity capture" feature indicates intermittent open and short circuits. It comes with test leads and a two-year warranty.

Every newcomer to electronics and amateur radio needs a good multimeter, and every seasoned enthusiast could always do with another one. And the chances of winning are *very* good!

Membership recruitment advertisements appear in each issue of *Amateur Radio* magazine, and in *Radio and Communications* magazine.

Membership recruitment and renewal advertisements are also on WIA Divisions' World Wide Web pages.

Packet Wormholes Close

The new Telecommunications Act, which took effect from 1 July, has been responsible for the closure of amateur packet wormhole stations at a number of tertiary education institution sites around Australia. It is believed at least eight wormhole sites have been affected.

Amateur wormhole stations link to other wormhole stations via a "virtual tunnel" through the Internet, the tunnel providing a "barrier" to non-amateur network computer systems connected to the Internet (see *Packet World* in *Amateur Radio*, June 1997, page 40). There is some contention that this sort of amateur station-to-station linking falls within the Australian amateur licence conditions. The issue has been under discussion between the WIA and the SMA (now the Australian Communications Authority) for the past several years.

Wormhole stations associated with private network facilities are believed to be unaffected, as yet.

University administrations began advising amateur wormhole station operators in late June that their connections would likely make the institutions a telecommunications "carrier" under the new Telecommunications Act. It is understood other services, not being directly faculty staff or students, which use tertiary institution network facilities, have also been affected.

One university obtained advice on the issue from the Department of Communications and the Arts (DoCA), which read: *"If a network unit has one owner (eg xxU) and is used to supply point-to-point carriage services, it is being used to supply a service to the public if BOTH end-users are outside the immediate circle (employees and students) of the owner (section 44(c)(i))."*

The WIA is monitoring the situation to keep abreast of further developments.

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When Icom sat down to design the original IC-706, it produced a quite unique radio with no peers... small — tiny, even — but a full 100 watts on all HF bands and six, plus 10 watts on two, and a general coverage receiver all the way to 200MHz. So what could it do to surpass that? We tell you all...

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- **DX Daily. This new daily on-line DX report promises a lot. Here's how to get hooked up to it...**
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ce

■ Test Equipment

Intermodulation Performance and Measurement of Intermodulation Components

Lloyd Butler VK5BR describes in detail what intermodulation performance should be expected, and how to measure it.*

Introduction

To define the performance of a receiver or transmitter, various specifications are recorded which are obtained from measurements carried out. Perhaps the least understood of these in amateur radio circles is intermodulation performance and how it is measured. The aim of this article is first to discuss intermodulation products and how they are produced and then look at how they are defined and measured.

What are Intermodulation Products?

When a single frequency (f1) is fed through a device whose output is not a linear function of its input, harmonics of f1 are generated, ie 2f1, 3f1, 4f1, 5f1, etc (no device is perfect and so harmonics are always generated even at low levels).

Now, if two separate frequencies exist together in a non-linear device, sum and difference frequencies are also produced in addition to the harmonics. This can be shown mathematically to be the result of a multiplication process between the two original frequencies and hence the two new frequencies are called products. If the two original frequencies are f1, f2 and the highest frequency is f2, then we can expect two other components (or products) of (f1+f2) and (f2-f1). However, it doesn't stop there. Since there are harmonics of f1 and f2, then there will be sum and difference products between all of the harmonics and the fundamentals and between each other. These are the intermodulation products which are frequency components distinct from the harmonic components discussed in the previous paragraph. Of course, if there are more than two fundamental frequencies, then the multitude of products is compounded further.

It can be shown, using a mathematical series, that when harmonics are generated, the harmonics extend upward in frequency to approach infinity, progressively decreasing in amplitude as the frequency increases. Likewise, the intermodulation products could also be considered to be infinite in number. However, we are only really interested in those of practical significance, that is of such a level that they might deteriorate the quality of our signal beyond an acceptable level.

To examine intermodulation products we will consider two frequencies f1 and f2 and some of the orders of intermodulation products. To define the order, we add the harmonic multiplying constants of the two frequencies producing the intermodulation product. For example, (f1+f2) is second order, (2f1-f2) is third order, (3f1-2f) is fifth order, etc. Let's consider f1 and f2 to be two frequencies of 100 kHz and 101 kHz respectively, that is 1 kHz apart. We now prepare Table 1 showing some of the intermodulation products.

Looking carefully at the table, we see that only the odd order intermodulation products are close to the two fundamental frequencies f1 and f2. One third order product (2f1-f2) is 1 kHz lower in frequency than f1 and another (2f2-f1) is 1 kHz above f2. One fifth order product (3f1-2f2) is 2 kHz below f1 and another (3f2-2f1) is 2 kHz above f2. In fact it is the odd order products which are closest to the fundamental frequencies f1 and f2.

Let's expand further the odd order products as shown in Table 2.

The series of odd order products can be seen to descend and ascend progressively in increments of 1 kHz from the two fundamental frequencies f1 and f2 respectively. A typical spectrum produced could be depicted as shown in the chart of Figure 1.

Of all the harmonics and

Table 1 – Intermodulation Products

1st Order	f1,	f2	100 kHz	101 kHz
2nd Order	f1+f2,	f2-f1	201 kHz	1 kHz
3rd Order	2f1-f2,	2f2-f1	99 kHz	102 kHz
	2f1+f2,	2f2+f1	301 kHz	302 kHz
4th Order	2f2+2f1,	2f2-2f1	402 kHz	2 kHz
5th Order	3f1-2f2,	3f2-2f1	98 kHz	103 kHz
	3f1+2f2,	3f2+2f1	502 kHz	503 kHz
Etc.				

Table 2 – Odd Order Products

3rd Order	2f1-f2,	2f2-f1	99 kHz	102 kHz
5th Order	3f1-2f2,	3f2-2f1	98 kHz	103 kHz
7th Order	4f1-3f2,	4f2-3f1	97 kHz	104 kHz
9th Order	5f1-4f2,	5f2-4f1	96 kHz	105 kHz
Etc.				

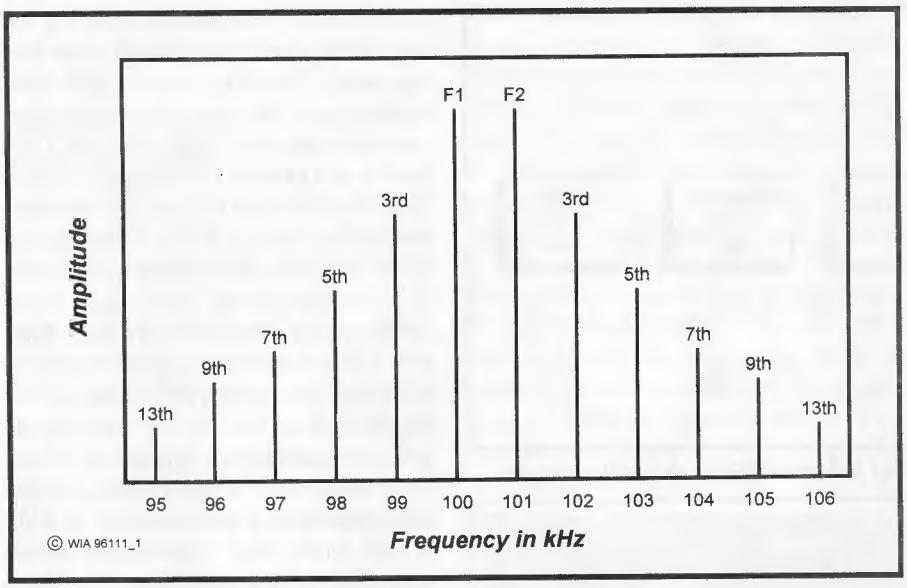

Fig 1 – Spectrum of intermodulation components.

intermodulation components produced, we are often only interested in those which fall in the passband of our equipment and, in the case of the intermodulation components, those which happen to be closest to our fundamental frequencies. The third order components are the closest and also usually the highest in amplitude. Because of this, they are usually the products of most concern and are those which are commonly measured and defined in transmitter and receiver performance specifications.

Effects of Intermodulation Components

The existence of intermodulation components affects the performance of equipment in various ways. First let's look at audio amplifiers. The presence of any component at the output of an amplifier, but not fed into it, degrades the quality of the signal being amplified. We call this distortion, which can be the result of non-linearity in the amplifier causing the generation of harmonics of

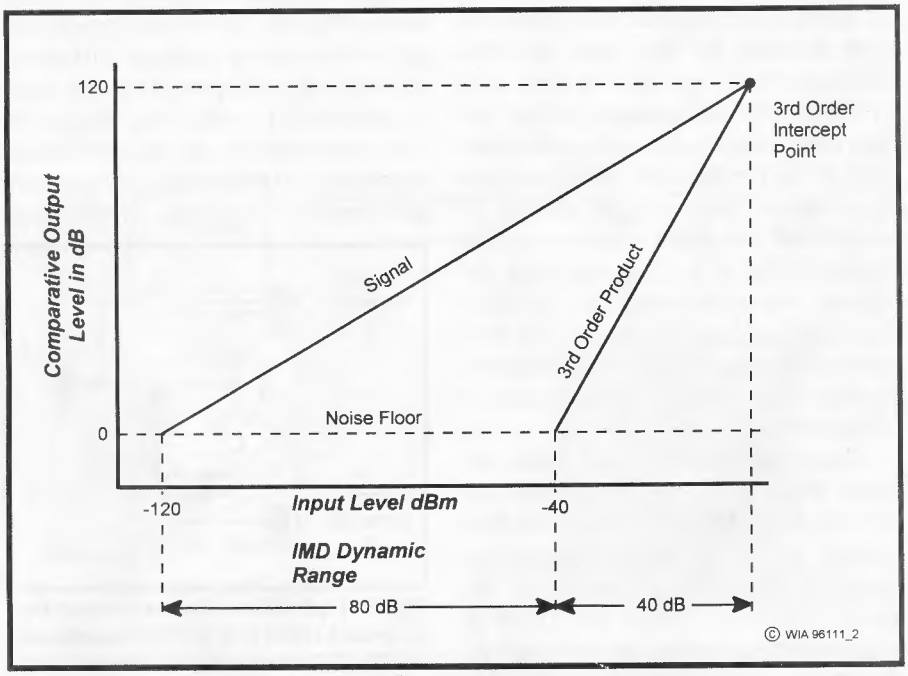

Fig 2 – Receiver intermodulation performance curves.

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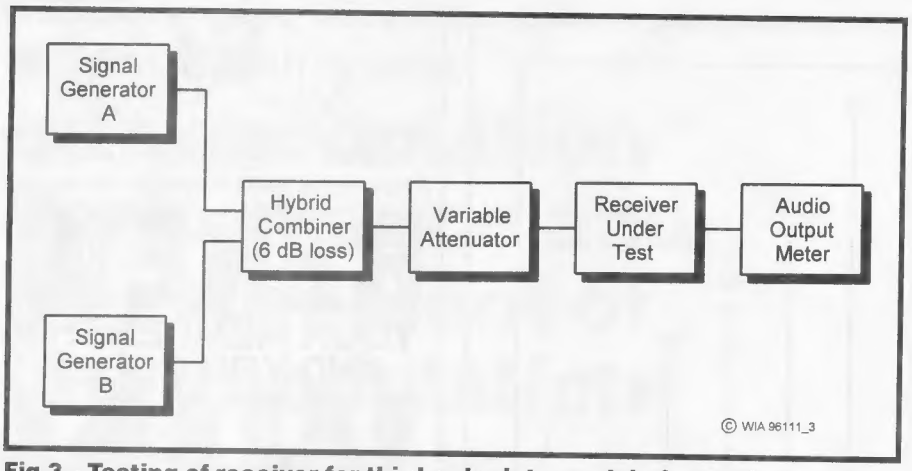


Fig 3 – Testing of receiver for third-order intermodulation performance.

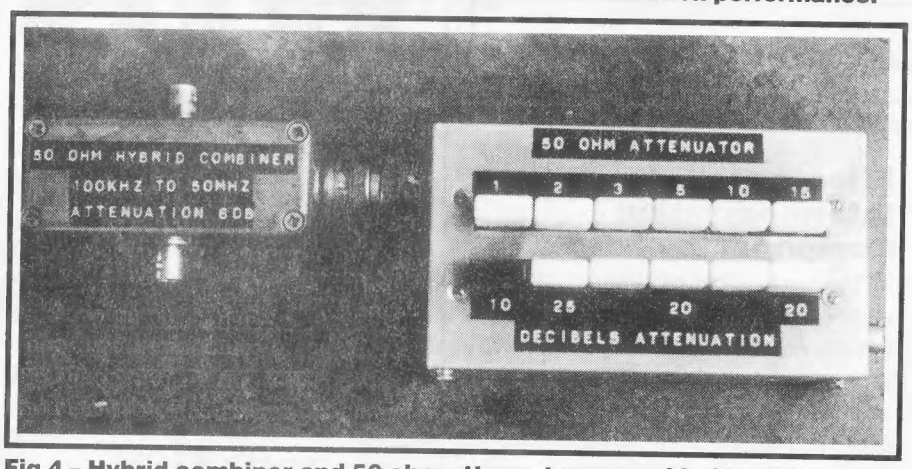


Fig 4 – Hybrid combiner and 50 ohm attenuator assembled by VK5BR.

the signal frequencies and, in turn, intermodulation components. So we have harmonic distortion and intermodulation distortion which can individually be defined. We often see intermodulation distortion abbreviated to IMD.

Some different effects can be experienced when non-linearity exists at RF in a transmitter and, in particular, in the final linear amplifier of the transmitter. Consider the amplifier delivering sideband components to the antenna at radio frequencies and, because of non-linearity, harmonics of the various sideband components are generated plus various intermodulation components. The harmonic components and the even-order intermodulation components will be well spaced away from the operating frequency, and hopefully attenuated by the tuned amplifier tank circuit and the antenna tuning system. Not so for the odd-order intermodulation components which are closely spaced around the fundamental components from which they were generated. First of all they will show up as audio distortion after being received and detected by the radio receiver. However, that's not all! We have seen from the previous paragraphs that the odd order components spread out either side of the fundamental components in progression gradually decreasing in amplitude. The effect is to broaden the radiated signal and, in receiving the signal, we experience the familiar sideband splatter. As most of us well know, this causes interference to others trying to use another channel near in frequency.

Another application where those odd order intermodulation components are of considerable concern is in the first mixer stage of a superheterodyne receiver. The special function of the mixer stage is to produce some form of non-linearity so that an intermediate lower frequency is formed from the sum or difference between the incoming RF signal frequency and a local oscillator frequency. The mixer stage is, therefore, a prime spot for other intermodulation products which we might not want. Let's look at an example. Our receiver is tuned to a signal on 1000 kHz but there are also two strong signals, f1 on 1020 kHz and f2 on 1040 kHz. The nearest of these (f1) is 20 kHz away and our sharp intermediate frequency (IF) stage filter of 2.5 kHz bandwidth is quite capable of rejecting this signal. However, the RF stages before the mixer are not so selective and the two signals f1 and f2 are seen at the mixer input, free to produce intermodulation components at will. Now work out the third order intermodulation component (2f1-f2) and we get (2x1020-1040) = 1000 kHz, right on our signal frequency. This is just one example of how intermodulation components or out-of-band signals can cause interference within the working band.

Another form of interference in receivers which results from the mixing of intermodulation components is Cross Modulation. This becomes more apparent when dealing with AM signals and the modulation on a strong out-of-band signal transfers itself across to modulate the signal being received. The process is probably complex but, due to non linearity in the receiver, one can well imagine the carrier and sideband frequencies of the out-of-band modulated signal mixing to produce difference second-order components at the audio frequencies of modulation. Due to the same non-linearity, the unwanted audio components intermodulate the signal being received. If the receiver is designed

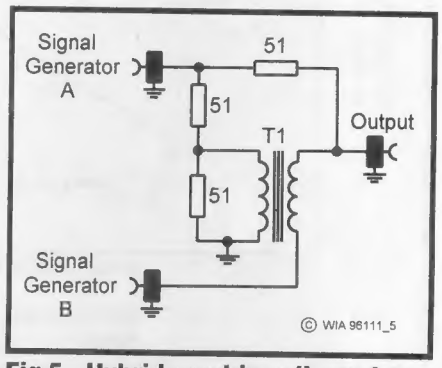


Fig 5 – Hybrid combiner (based on a circuit from the ARRL Handbook, ref 2). T1 consists of 10 turns bifilar wound on FT50-72 core.

for good intermodulation immunity, it will also have good cross modulation immunity.

Receiver IMD Performance

To assess the receiver for its tolerance against interference from internally generated intermodulation products, the receiver is tested for its sensitivity to third-order products using two equal-level signals fed to its input and typically 20 kHz apart. The receiver is tuned to the frequency of one of the third order products derived from the two signal frequencies. The level of the combined signals at the input is adjusted until the detected output level is equal to that generated by the receiver's self noise. That is, there is a 3 dB change in output level between when the signals are on and when they are off. The level of the third order product necessary to produce output equal to the receiver "noise floor" is recorded. For the purposes of following discussion we will call this level IMD Threshold.

We also need to know the normal signal input level which produces audio output equal to that of the receiver's own inherent noise or its noise floor. This is done by tuning the receiver to one of the two frequencies and again adjusting input level to give an output level 3 dB above the noise output level. For the purposes of the discussion we will record this input level as the Signal Threshold. The difference in dB between the IMD threshold and the signal threshold is called the Intermodulation Dynamic Range or IMD Dynamic Range. The higher the difference, the better the immunity to interference from IMD products.

Now, there is an important characteristic of the third-order products which makes their presence more of a problem than one might first imagine. Assuming no compression (due to AGC, etc), output from a fundamental signal is proportional to input, ie for 10 dB rise in input level there is 10 dB rise in output level. However, the output of the third order product is proportional to the cube of signal input level and, for a 10 dB change in input level, the product increases by 30 dB.

Now refer to Figure 2. One curve plots a linear rise in output level against input level for the fundamental signal frequency. The other plots the level of third-order IMD products against input level, the output rising 30 dB for every 10 dB change in input level. At an output level equal to the noise floor, the two curves are separated by an input level difference equal to the IMD Dynamic Range. As the intermodulation curve rises with greater slope than the fundamental curve, they cross at a point called the Third-Order Intercept Point where the intermodulation product output level is equal to the fundamental signal output level.

The Third-Order Intercept point is normally a theoretical point well above the receiver overload level. However, it is often specified to define intermodulation levels, and particularly in specifications for mixer packages.

The Third-Order Intercept point can

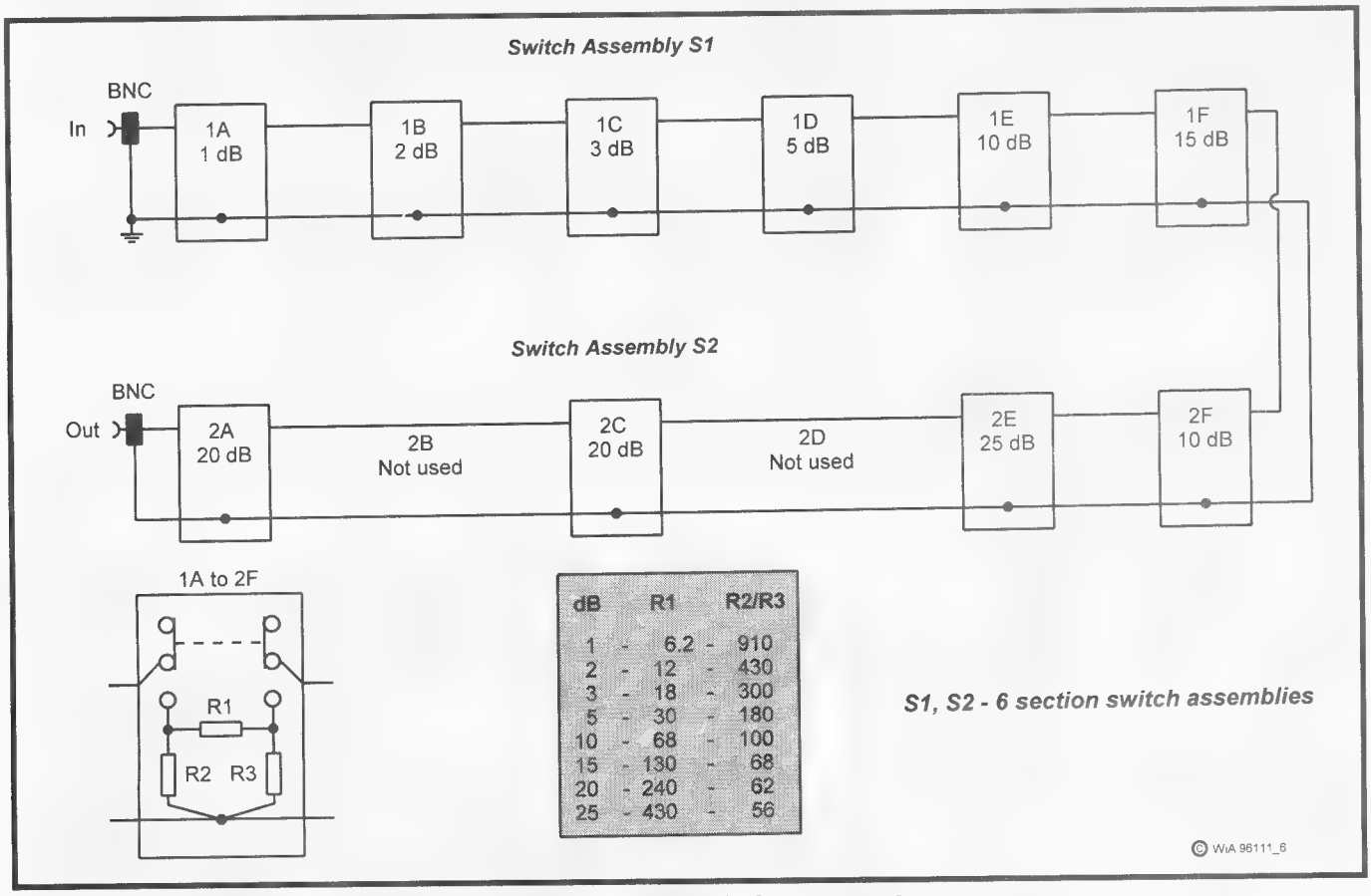


Fig 6 – Circuit diagram (simplified version) of the VK5BR 50 ohm attenuator.

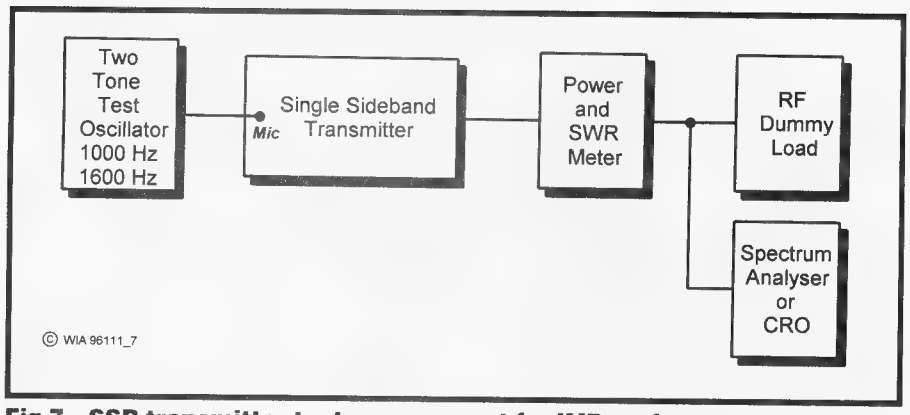


Fig 7 – SSB transmitter test arrangement for IMD performance.

be derived on decibel scales by first extending the signal curve linearly from the signal threshold point on the noise floor axis so that output level increase in dB equals input level increase in dB. Mark the IMD threshold point on the noise floor axis. This is at an input level higher than signal threshold by an amount equal to the IMD dynamic range. Mark another point on the noise floor axis beyond the IMD threshold point by an amount equal to half the IMD dynamic range. Extend this point vertically to cross the signal curve and this is the Third-Order Intercept point. Join this point to the IMD threshold point to complete the curves such as is shown in Figure 2. In the diagram, the noise floor input level is -120 dBm, the third order components become detectable at -40 dBm and the IMD dynamic range 80 dB. The theoretical third-order intercept occurs at an input level of 120 dB above the noise floor input level.

It can be seen from the curves of Figure 2 that, above the IMD threshold level, the IMD products can become quite a problem. In the example, IMD products from out-of-band signals at an input level of -40 dBm would barely be apparent. Increase the level by a mere 10 dB and the interference from these products would increase by 30 dB.

Receiver Measuring Gear

To carry out intermodulation performance on a receiver, the set-up shown in Figure 3 is required. The RF outputs of two signal generators are combined in a hybrid circuit designed to prevent interaction between the two generators. A hybrid circuit is balanced so that a signal at any one input port cannot reach the other. However, both signals appear combined at an output port.

The combined output is fed to the receiver via an adjustable attenuator with a range up to around 80 dB and resolution of 1 dB. Assuming that the receiver has an input resistance of 50 ohms, both the combiner and attenuator are designed for a circuit impedance of 50 ohms.

A hybrid combiner and attenuator assembled by the writer is shown in Figure 4. The hybrid circuit, Figure 5, is one taken from the *ARRL Handbook*. The combiner has an insertion loss of 6 dB for each signal channel.

The attenuator was made up using two mechanically interlocking, in-line switch assemblies of the type similar to those used in older style push-button car radios. The assemblies, each of six switches, were recovered from some old intercom units and each switch came with plenty of change/over contacts to switch in or out an attenuation pad. One assembly switches in 1 dB, 2 dB, 3 dB, 5 dB, 10 dB and 15 dB pads. The other switches in 10 dB, two of 20 dB and 25 dB pads. Up to three switches on each assembly can be simultaneously pressed to lock in so that up to six pads can be in circuit together to provide a continuous selection of total attenuation between 1 and 95 dB. The circuit diagram of the complete attenuator is shown in Figure 6.

The only other device necessary is some form of AC voltmeter to measure the comparative level of audio signal at the receiver output. All it is required to do is to record a 3 dB change in level above the receiver noise floor. In terms of voltage increase, this is a rise of 1.4 times.

Our references have so far been made to levels in dBm, or decibels referred to one milliwatt. However, signal generator outputs are commonly calibrated in microvolts and millivolts with scales in multiples of 10. To convert between units, 1 mV across 50 ohms is -107 dBm. Each time the voltage is multiplied by 10, add 20 dB so that 10 mv is -87 dBm, 100 mV is -67 dBm, etc.

To find the signal threshold, set one signal generator to a fairly low level (say 10 mV or -87 dBm) and tune the receiver to the signal generator frequency. Adjust the attenuator so that the signal raises the audio output signal just 3 dB (1.4 times volts) above the noise level (measured

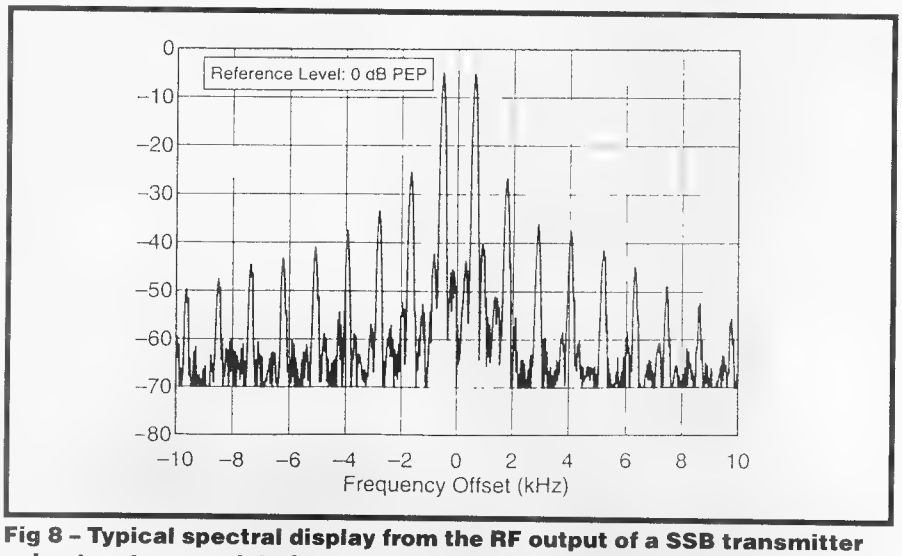
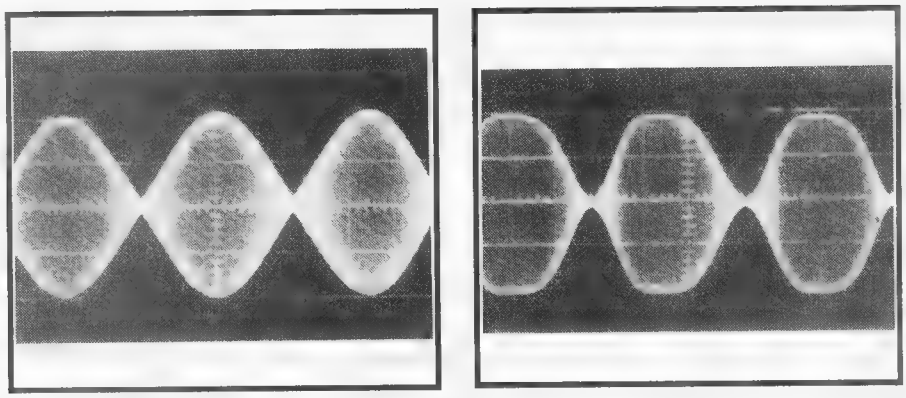


Fig 8 – Typical spectral display from the RF output of a SSB transmitter using two tone modulation and showing the intermodulation products generated (sample from ARRL test in March 1996 issue of QST).



9A 9B

Fig 9 – SSB two tone test showing RF waveform on a CRO. (a) Good waveform. (b) Peaks compressed (IMD high, sideband splatter).

with signal off). The signal threshold in dBm is equal to -87 dBm, minus the loss in dB set by the attenuator, minus 6 dB loss in the hybrid combiner.

To find the third-order IMD threshold, set the two generators (20 kHz apart in frequency) to an equal level somewhat higher, such as 10 mV (-27 dBm). Tune the receiver to the frequency of one of the third-order products. Adjust the attenuator until the audio output from the third-order signal is just 3 dB above the noise level. The IMD threshold is equal to -27 dBm, minus the loss in dB set by the attenuator, minus 6 dB loss in the hybrid combiner.

Transmitter Tests

To check out a single-sideband transmitter for those intermodulation components which cause sideband splatter, we need a two tone audio generator to feed into the microphone input of the transmitter. This can be quite a simple test unit, consisting of two fixed frequency oscillators delivering the same output level into a resistive network which combines the two signals. Simple two tone generators have been presented in *Amateur Radio* from time to time. In the March 1983 issue, the writer described one using two FX205 Tone Generator packages. In this one, frequencies were set at 1000 Hz and 1600 Hz.

A test arrangement for the transmitter is shown in Figure 7. The two tone oscillator level is adjusted to provide full RF power from the transmitter into a dummy load. Power can be monitored with the usual Power/SWR meter. Apply the audio signal in short bursts as most single-sideband transmitters are designed for speech and the final amplifier stage might be damaged if sustained on continuous full power. The best way to monitor the level of the various intermodulation sideband components is to examine the RF output signal using a Spectrum Analyser.

Figure 8, taken from March 1966 issue of *QST*, is a typical spectrum analyser display of the RF output of a single-sideband transmitter fed with two audio tones 1000 Hz apart. Two fundamental RF sideband frequencies are created but we can also see a family of odd-order intermodulation frequencies either side of the two fundamentals with all frequencies spaced 1000 Hz apart. The display shows that the third order products are around 21 dB below the fundamentals, the fifth order 30 dB below, the seventh order 33 dB below, etc, in decreasing amplitude as the order progresses.

Whilst the spectrum analyser is the order of the day in the modern electronics laboratory, not many radio amateurs could boast of one in the radio shack. However, the Cathode Ray Oscilloscope (CRO) is a more common piece of test gear, and with this we can get some idea of whether there might be an excessive spread of intermodulation sideband components. Figure 9, taken from the *ARRL Handbook*, shows CRO displays of the RF output generated from a two tone audio source fed to the transmitter. In diagram A, the waveform is quite good and we could expect a fairly clean signal transmitted. In diagram B, compression of the waveform peaks is occurring, possibly because the final amplifier is being driven too hard into a state of poor linearity. If there is poor linearity, then we can expect intermodulation components to be generated and sideband splatter.

Another test that might be applied is to demodulate the transmitter so that we get the two tones back as audio. Perhaps a station receiver can be used for this purpose if it can be prevented from being

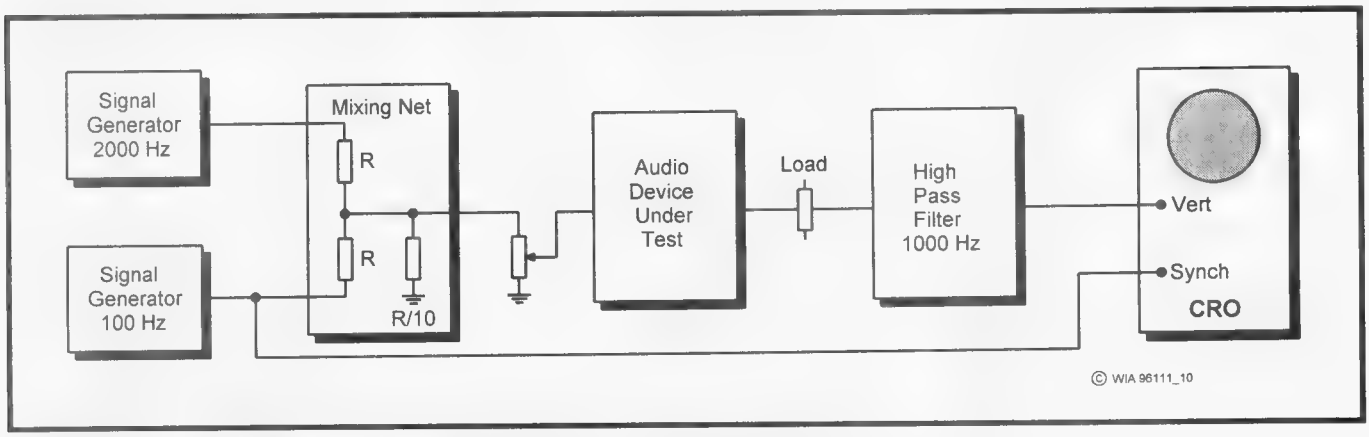


Fig 10 – Test for audio intermodulation distortion using a CRO display.

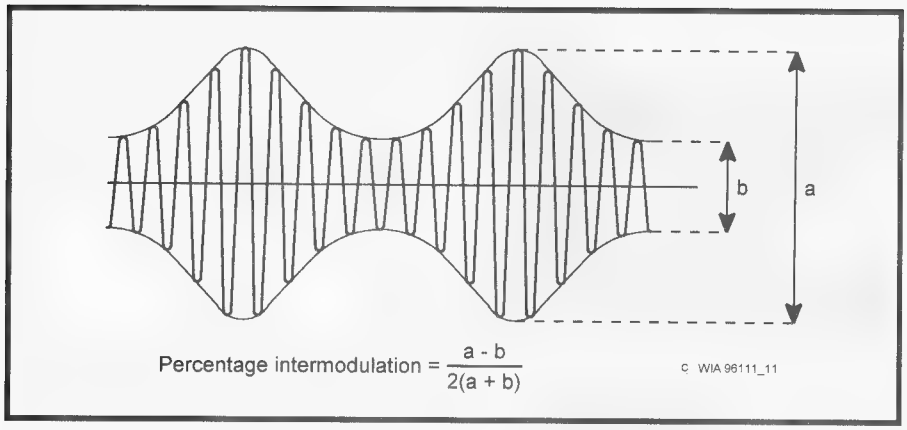


Fig 11 – CRO display waveform of intermodulation and method of measurement.

overloaded by the transmitter. The audio intermodulation distortion tests as described in the following paragraphs can then be carried out. The tests could apply to any mode of transmitter and matching receiver whether it be SSB, AM, or FM (for AM, a simple rectifier and RF filter would be adequate for demodulation). The only problem with this form of test is that the distortion measured is the combined distortion of both transmitter and receiver. If excessive distortion occurred, one would have to be certain that it wasn't caused by the receiver.

Measurement of Intermodulation Distortion at Audio Frequencies

As with other tests described, two audio signals at different frequencies are fed through the device to be tested and the output is monitored. If a modern spectrum analyser is available, the relative amplitudes in decibels from all components at the output can be displayed. As the X axis of the analyser display is calibrated in frequency, the various intermodulation components can be identified and their amplitudes recorded relative to the two fundamental frequencies.

Another instrument of a past era, but which can do a similar job, is the Heterodyne Wave Analyser. This is, in effect, a sharp tuneable filter which achieves its sharpness and tuneability by heterodyning the measured signal with a tuneable oscillator and passing the difference frequency through a sharp fixed 50 kHz crystal filter. By adjusting the tuneable oscillator, the various frequency components can be selectively tuned in and the outputs at 50 kHz can be compared. The Wave Analyser was described in the writer's previous article on Measurement of Distortion, *Amateur Radio* June 1989.

Another method to measure the intermodulation level is to make use of a CRO display as shown in Figure 10. Two audio signals of widely different frequency are combined and fed into the device under test. The lower frequency signal has an amplitude four times that of the higher frequency signal. The output of the device is fed to the CRO vertical plates via a high pass filter which removes the low frequency signal. The CRO time base is externally synchronised to the low frequency signal. Intermodulation is shown on the display as an amplitude modulation waveform of the lower frequency on the higher frequency carrier. The reason for the four to one signal amplitude ratio is to amplify the apparent modulation and improve resolution in reading the display. The test set-up, shown in Figure 10, uses a 100 Hz low frequency signal and a 2000 Hz high frequency signal. A simple resistive mixing network is used to prevent interaction between the audio generators. Referring to Figure 11, percentage intermodulation is calculated from a and b scaled on the CRO display as: % Intermod = (a-b)/2(a+b).

In this test, it should be clear that we are essentially measuring the effect of the second-order intermodulation components at (f2-f1) 1900 kHz and (f2+f1) 2100 kHz. This should not be confused with the fact that at radio frequencies we had been mainly concerned with the odd-order products because it was those which appeared in close to our tuned band. However, at audio frequencies, both odd and even products fall within the audio band.

Summary

Intermodulation products have been discussed with particular attention to how their presence affects our transmitter and receiver circuitry. In audio circuits, they are one of the contributing distortion factors which deteriorate audio reproduction quality. At radio frequencies in transmitters, they appear as what we recognise as sideband splatter. In receivers, circuits susceptible to their generation encourage interference from signals outside the receiver pass-band.

Various ways have been explained as to how intermodulation components can be measured and how the equipment performance in terms of IMD susceptibility can be specified. The reason why the third order performance is usually defined in RF circuits has also been discussed.

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1. *Lloyd Butler VK5BR: Measurement of Distortion – Amateur Radio, June 1989.*
2. *ARRL Handbook 1989: Chapter 25 – Test Equipment & Measurements; Chapter 18 – Voice Communications.*
3. *Jon Dyer G4OBU: High Frequency Receiver Design – Radio and Electronics World, July 1983.*
4. *Lloyd Butler VK5BR: A Discussion on Mixers – Amateur Radio, April 1988.*
5. *Lloyd Butler VK5BR: Two Tone Test Oscillator for SSB – Amateur Radio, March 1983.*

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■ Measurement

Simple Peak-Reading Watt-Meter

Jon Lindstad VK2WF describes how to convert your watt-meter to a PEP reading meter.*

Most watt-meters used by amateurs are average reading voltmeters calibrated in watts at 50 ohms. These watt-meters will indicate the power level transmitted by a steady carrier, or if you whistle into the microphone while in SSB mode. During normal speech, however, these watt-meters indicate considerably less than the actual PEP output. The watt-meter described below is a peak-reading voltmeter calibrated in watts at 50 ohms. It is quite simple and will indicate the peak power output during normal speech.

Referring to Fig 1, you will see that the circuit is a simple HF rectifier. Without the meter circuit and the six 1 megohm equalising resistors, C would be charged to the positive peak voltage of the transmitted signal and stay charged. The meter, and meter resistance Rs, form a discharge path and, with a proper discharge time constant, the circuit will operate in much the same way as the S-meter in your transceiver; that is it will respond quickly to the peak output level and discharge slowly enough to enable you to read the power level.

So, how does this circuit differ from the more common output meters? The difference is in the discharge time constant. This circuit utilises the full voltage on the transmission line and charges the capacitor to the peak Tx-line voltage. The required discharge current is determined by the sensitivity of the moving coil meter, say 100 µA full scale. The value of the meter resistor Rs, and hence the time constant, is then proportional to the available voltage on the capacitor C. Note that the time constant will be modified by the six equalising resistors.

PEP, or "peak envelope power", is the power that would have been transmitted if the signal shown in Fig 2a had been a sine wave with the same peak voltage as shown in Fig 2b across the same resistive load. So, if V_p in Fig 2a is, say, 80 volts, then:

$$PEP = (V_p*0.707)/50 = 64 \text{ watts}$$

If R_s = 1 megohm then the meter current would be:

$$I = 80/1^{E6} = 80\,\mu A$$

Note that the notation 1^{E6} means 1 times 10 to the power 6.

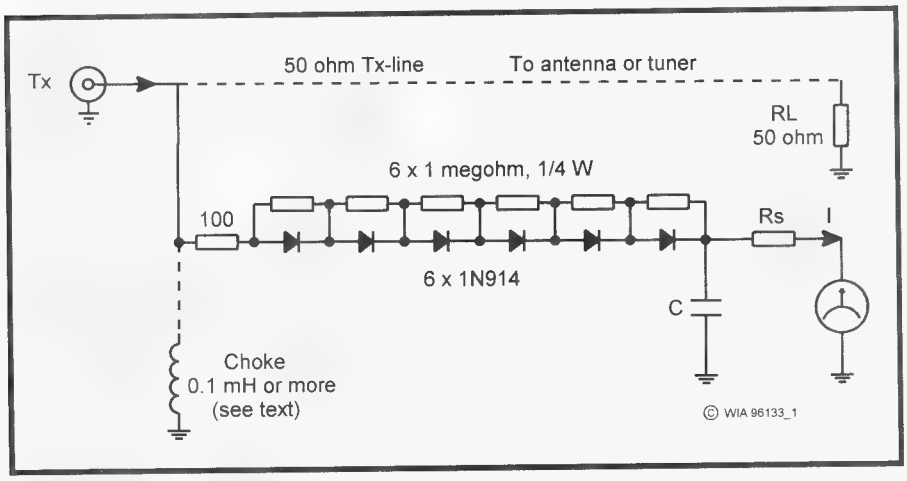

Fig 1 – Circuit of the peak-reading meter.

A Design Example

Let's say we want to build a watt-meter indicating 400 watts PEP at the 80 µA mark using a meter movement with 100 µA full scale deflection (FSD). For convenience we will disregard the small voltage drop across the diodes and the resistance of the meter movement itself. The following variables are used:

V_p – peak voltage on transmission line
P – power represented by sine wave with same Vp as SSB signal
I – meter current
RL – Tx line and Load impedance
R_s – meter circuit resistance
C – holding capacitance
T – discharge time constant

We then have:

$$V_p = \sqrt{2 * P * RL}$$
$$= \sqrt{2 * 400 * 50} = 200V$$

That is, C will be charged to 200 volts if 400 W PEP is being transmitted. To get 80 µA current through the meter:

$$R_s = V_p/I = 200/80^{E-6} = 2.5 \text{ megohm}$$

Note that the notation 80^{E-6} means 80 times 10 to the power -6 or 80/1000000.

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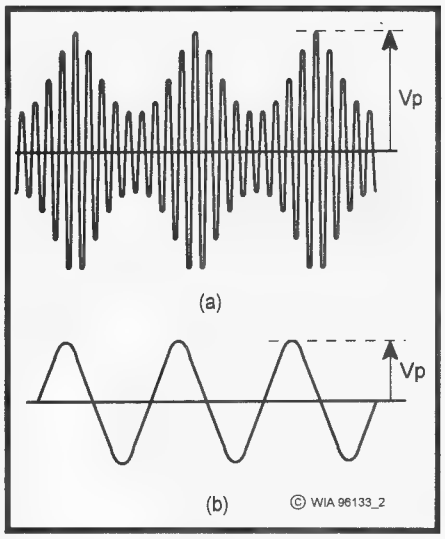

Fig 2 – (a) SSB waveform. (b) Sine wave.

The value of C should be between 2 and 5 µF. The combined discharge resistance is 2.5 megohm in parallel with 6 megohm. However, the six 1 megohm resistors will only draw current from C half the time, but then towards a varying negative potential. My "guesstimate" is 2.5 megohm in parallel with 9 megohm, ie approximately 2 megohm. With a C of 5 µF the time constant would be:

$T = 2^{E6} * 5^{E-6} = 10$ seconds

Try experimenting with the value of C. The inertia of the meter movement will probably influence your choice.

Calibrating the Scale

With the 400 watt mark at 80 µA, you would have 100 watts at 40 µA and 25 watts at 20 µA. If you want to calibrate the scale in more detail, the following equations will give the figures:

$$V_p = \sqrt{2 * P * 50}$$

and

$$I = V_p / 2.5^{E6}$$

This yields the following table:

PEP	V_p	I (µA)
400	200	80
300	173	69
200	141	56
100	100	40
75	86.6	35
50	71	28
25	50	20

At full scale (100 µA), the PEP would be 625 watts.

Final Notes

1. A small light weight µA-meter will respond quicker than a larger one and will be more accurate in spite of the smaller scale.

2. The capacitor C will be charged to V_p so, on the negative half cycle of the signal, the reverse voltage across the diodes will be $2*V_p$. Note, however, that this is only so if the SWR on the line is 1:1. A high SWR will result in a significantly higher reverse voltage. This has to be taken into account in the selection of diodes and the number used in series. The author has used five diodes (1N914) during the last two sunspot cycles when a 400 W homebrew amplifier was used a lot. The diodes were blown twice in this time span due to high SWR (forgetting to tune up!). At least six diodes is recommended.

3. The choke L shown in Fig 1 between the Tx-line and ground is only necessary if your Tx output does not have a low resistance path to ground. Most transmitters do. Try without the choke first. If it does not work, put one in.

*PO Box 457, Armidale NSW 2350

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QSP News

Changes to Search and Rescue

Effective from 1 July 1997, Aviation and Marine Search and Rescue functions in Australia will become the responsibility of a new national SAR organisation which will be known as AUS-SAR. AUS-SAR will combine the Search and Rescue roles currently provided by Airservices Australia and the Australia-Maritime Safety Authority Rescue Co-ordination Centres.

Services are accessible on the following 1800 numbers:

Aviation	1 800 815 257
Aviation	1 800 624 077
Aviation	1 800 640 507
Maritime	1 800 641 792
FAX	1 800 622 153

(information from Damien VK3RX)

■ Antennas

A Two Metre X Beam

Paul Clutter VK2SPC describes a compact beam for 2 m.*

After acquiring a two metre handheld transceiver, the next obvious task was organising suitable antennas. The rubber ducky and various other telescoping mobile antennas served their limited purposes and a 5/8 vertical kept me in touch while searching through handbooks and antenna books for something better.

After considering all the pros and cons of Yagis, quads, Js, and Vs, etc, I decided to try an X beam which appeared in the *ARRL Handbook* and *Antennas Compendium Vol 1*. This antenna was developed by W9PNE and is a compact version of the two element. However, the handbook did not include any details above 28.2 MHz, but the formulas were developed after many measurements on a large number of X beams.

One reason for selecting this antenna was that no matching network is needed. A 50 ohm coax feeder goes directly to the driven element. Also, the frame is easily constructed, the antenna is broadband with low SWR, and a long boom is not needed.

The first beam, not included in Fig 1, was made with 1/2 inch diameter tubing, ex-TV antenna, with 12 gauge B&S self-supporting wire for the tails. No frame was needed as the tubing was saddle-clamped on a piece of Perspex. As the antenna was used vertically, a 24 inch (600 mm) long piece of timber, 1/2 x 1 inch (12.5 x 25 mm), was attached at the hub to bring the coax away from the

necessary with horizontal polarisation as the coax would be running down at right angles to the plane of the elements.

Trimming the tails at 146 MHz, the best SWR was 1.5:1 and comparison tests with other antennas gave an indication of some gain. I decided to make another beam (beam No 2) as the arm length to diameter ratio was 32 to 1 (16 inches long x 1/2 inch diameter), whereas the handbook specification suggested a 200 to 1 ratio. This first beam was later dismantled after making the second and third beams.

The second beam (see Fig 1) was made with arms of the aluminium from the connecting rods of the ex-TV antenna. The dimensions were 0.158 inch diameter and 16 inches long (4 x 406 mm approx). The ends were flattened and drilled to bolt the tails on with 8 BA screws. This gave the arms a diameter to length ratio of 101 to 1. Many sizes of tail wires were tried. Nos 12, 16, 18, 20, and 24 gauge were tried and the best SWR and bandwidth was obtained using No 24 B&S (0.020 inch or 0.5 mm).

As the SWR and bandwidth were much better with the second beam, I decided to make number three with smaller diameter arms to get the length to diameter ratio closer to 200 to 1. Ideally, a 12 gauge B&S (0.080 inch or 2 mm) wire for the arms would give the 200 to 1 ratio but, as I did not have enough 12 gauge wire left from a secondary transformer rewind, I looked around for something near to the size. I found a bundle of coat hangers in the garage which looked promising. After measuring several I found enough to make the arms with a diameter of 0.085 inches. This wire was easily soldered and the size resulted in a 188 to 1 ratio with the bandwidth even better than the No 2 beam.

During the process of trial and error testing I put a 1/4 wave matching stub (bazooka or Pawsey stub) on all beams and found no advantage; I then removed them. The gain is approximately 6 dBd and the front to back ratio is at least 12 dB.

*52 Keats Avenue, Bateau Bay NSW 2261

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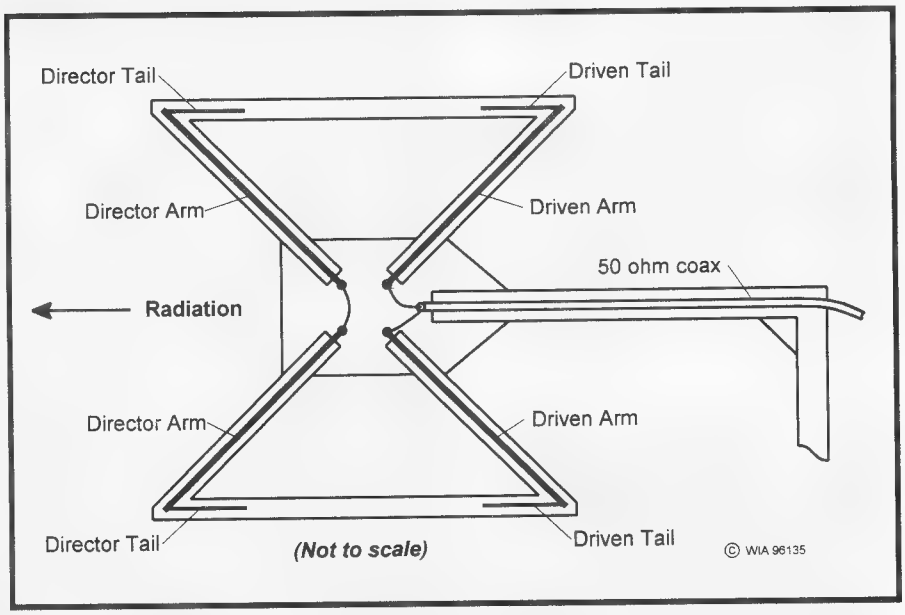

Fig 1 – X beams layout. The arms and tails are laced to the frame with waxed cord.

Second beam details:

Frame piece.	1/4 x 3/4 inch timber strips mounted on a 3/16 inch, 3 ply centre	
Arms	Aluminium rods 0.158 inch diameter x 16 inches long. Length to Diameter ratio 101 to 1.	
Driven tails	No 24 B&S (25 BSWG) wire (0.020 inch) x 5 1/8 inches long.	
Director Tails	No 24 B&S (25 BSWG) wire (0.020 inch) x 4 1/4 inches Long.	
SWR Readings	144 MHz	1.08:1
	145 MHz	1.04:1
	146 MHz	1:1 (0 reading on reverse of SWR meter)
	147 MHz	1.04:1
	148 MHz	1.08:1

Third beam details:

Frame	Same as second beam.	
Arms	Coat hanger wire – 0.085 inch diameter x 16 inches long. Length to Diameter ratio 188 to 1	
Driven tails	Same as second beam x 4 inches long	
Director tails	Same as second beam x 3 inches long	
SWR Readings	144 MHz	1.04:1
	145 MHz	1:1 (0 reading on reverse of SWR meter)
	146 MHz	1:1 (0 reading on reverse of SWR meter)
	147 MHz	1:1 (0 reading on reverse of SWR meter)
	148 MHz	1.04:1

Sign up a new WIA member today – we need the numbers to protect our frequencies and privileges

■ Events

An Enjoyable Weekend in Central Queensland

Jeff Aust VK4ABJ reports on the 1996 RADAR Club convention.*

Jack VK4JRC, one of the winners in the home brew competition, receiving his prize from President, Lyle VK4ALD.

Amateurs and enthusiasts came from all over Queensland, even NSW and New Zealand. The convention was organised by the Rockhampton and District Amateur Radio Club Inc, the "RADAR Club" and held at the YWCA Hall, Robinson Street in North Rockhampton over the second last weekend of September.

Visitors were welcomed and greeted with a specially designed courtesy bag full of relevant goodies. Amongst them were tickets for the venue, Saturday's local newspaper plus tourist info, lucky door and free barbecue tickets. This promised to turn into a pretty good weekend; indeed, the warm welcome did not go unnoticed, nor did the twelve degree drop in temperature in the evening.

What a pleasant surprise for most of us when we learned that our registration ticket qualified for one of many door prizes. Someone mentioned that at least one in every 20 registrations would be a winner. Obviously, the "most wanted" tangible was unquestionably the new IC-T7A dual-band 2 m/70 cm hand held radio valued at $765 and sponsored by Kevin Cavanagh VK4SP in association with Icom. Kevin and his wife Diane arrived several hours early to set up a big and magnificent display of equipment; everything an amateur could wish for, from budget priced hardware to the very latest in transceivers with modern digital communication modems.

The WIAQ's executive, among a bus load of twelve, also arrived early. All came from South East Queensland, paid their own way to meet local amateurs and set up an impressive display including a book shop and QSL bureau. One should recognise that all these people have spent a lot of their own time promoting amateur radio state wide at several venues this year. Geoff VK4KEL spoke on the WIAQ role and objectives, WIA federal liaison, membership and promotion.

The convention was officially opened by Ron VK4KJ. We were able to sit down and learn from several technical talks. Brian Powell from Access Electronics presented a commercial approach regarding repeater linking and displayed locally manufactured equipment. The talk by Kevin VK4SP on digital communications provided us with some insight into digital compression techniques.

Jack VK4JRC set up a TV transmitter and generated some live and recorded TV transmissions from the site on UHF. The WIAQ Broadcast by Graham VK4BB also originated from the site, and there was some packet activity. Well restored antique broadcast radios were displayed by Ian Long.

Radio Sport has come a long way in recent years and some good direction finding equipment was displayed and explained by Ron VK4BRG and Jeff VK4ABJ. Following that presentation, several transmitters were activated in an open area nearby, so that interested people could familiarise themselves with this equipment. The transmitters identified themselves, radiating AM-modulated CW bursts and only transmitting for one minute in every five.

The real test, though, was kept for the next day when Frank VK4CAU and Jim VK4AJS went hiding in some bush land just outside Rockhampton and activated a fox for a mobile competition. Against all the international rules, this fox was a devious one. Instead of a non-directional antenna, it had a Yagi that produced some considerable reflecting lobes, that would easily "throw off course" any experienced hunter. Five teams left in their cars, but only three teams were successful in finding the location.

The other group making amateur radio more diverse in recent years is ALARA. The ladies of this group organised a display of their interest and activities and entertained the evening gathering. And guess who organised that stunning presentation! A comedy romp that was funny, sexy and facetious. Most of us would never have seen anything like this. Well done ladies! That was unique and very entertaining! Their

Geoff VK4FK won the door prize raffle, an IC-T7A sponsored by Kevin Cavanagh VK4SP in association with Icom.

presence and assistance was much appreciated and makes us realise that the hobby is not just male orientated.

Peter Naish VK2BPN, one of our WIA federal directors, provided an excellent talk on future directions and commitments by the WIA. It gave us some insight into how much work, cost and activity is required to preserve and protect the current privileges of our hobby. Little do we realise that amateur radio, as we know it, would cease to exist eventually, were it not for the endless dedication and time these people devote to the WIA.

Clive VK4ACC, assisted by John VK4EII and Shawn, soon provided excellent barbecue lunches – hot dogs and sausage sizzles. It was over these delicacies we discovered that a few OMs hadn't met nor seen each other for 10 or 20 years. In several cases they did not even recognise each other until introduced. I found myself in one of these pleasant situations.

And Rodney Harold's Laser Display! It seems amazing how small mirrors can be moved and stopped so fast and with such precision, deflecting a laser beam repeatedly drawing a picture. The resulting image is one that is smoothly updated by computer, providing impressive motion and visual effects.

The weekend wound up with the presentation of prizes, including one for the visitor who travelled the longest distance. It went to a New Zealand visitor, Harry ZL4AB. More prizes were awarded for home brew equipment and handicraft ware, software design and radio sport competitions, etc. All in all this event was deemed long overdue for Central Queensland amateurs. The organisers and helpers deserve credit for their efforts including the splendid dinner function on Saturday night.

85 Conner Street, North Rockhampton QLD 4701

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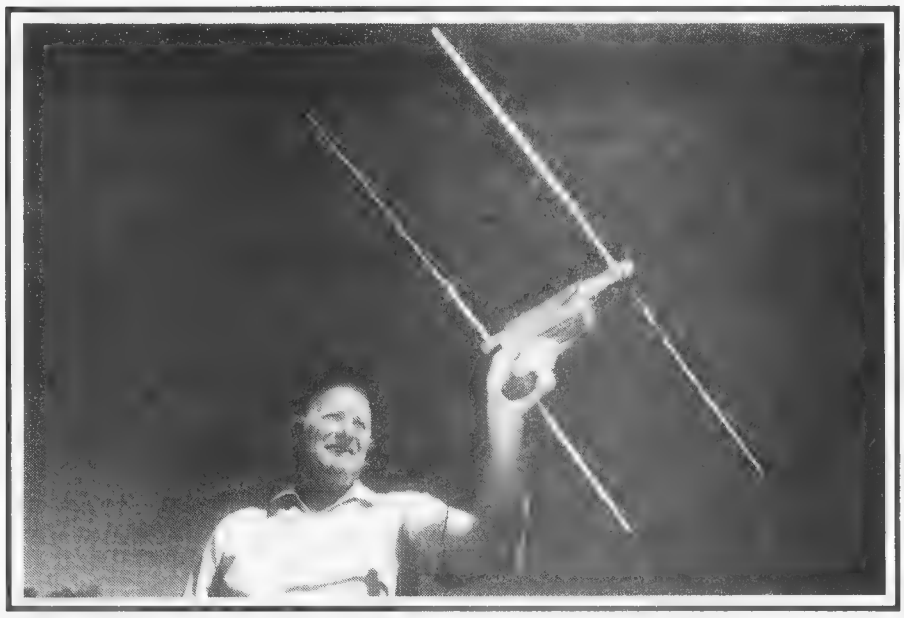

Frank VK4CAU testing his ARDF equipment.

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■ Technical

Technical Abstracts

*Gil Sones VK3AUI**

13 cm ATV Exciter

A simple synthesised 13 cm ATV exciter appeared in *CQ-TV* No 178, Spring 1997 edition. The exciter has an output of 10 mW and it produces an FM ATV signal. The exciter was the work of Jan F Bennett G6TVJ and uses a Plessey SP5070 synthesiser together with some MMICs and a few common components.

The synthesiser chip has a divide-by-256 stage built in and so a fairly standard crystal can be used. The MMICs are standard MMICs and should not present any difficulty. The VCO trimmer is one of the SKY trimmers used in the UK and it is a 5 pF maximum type.

The circuit is shown in Fig 1. It is a fairly simple circuit. The crystal for the local frequency of 2439 MHz should be 9.527344 MHz. Our band allocation is a little different from that in the UK due to the allocation of Pay TV Channels. The capacitors in the 2.4 GHz parts of the circuit should be microwave SMD types. The circuit board is double sided with only one side etched. The two sides ground planes are connected by a number of soldered pins.

The circuit layout of the critical parts is shown in Fig 2. The circuit board tracks are shown in Fig 3. The PCB in Fig 3 is scaled even though Fig 3 is not to scale as printed. There is a 2 cm bar shown so you can adjust it to size. Bear in mind, though, that the sort of PCB will have a bearing on the Microstrip track widths. These should be 50 ohms for the PCB you are using.

CQ-TV is the publication of the BATC. They have a Web site at *http://ourworld.compuserve.com/homepages/batc* which may be of interest if you are interested in ATV. You may also direct membership enquiries to Dave Lawton G0ANO, "Greenhurst", Pinewood Road, High Wycombe, Bucks, HP12 4DD.

Compact 160 Metre Vertical

A compact 160 metre vertical using commercial 160 metre whips appeared in *RadCom* for June 1997. The author was B Rose G3WWO.

The whips are used both as the radiating element and as the radials. The configuration of a vertical quarter wave equivalent and two radials is the simplest form of the original ground plane design.

The radiator consists of the mobile whip mounted on top of an extension made up of a four metre aluminium tube

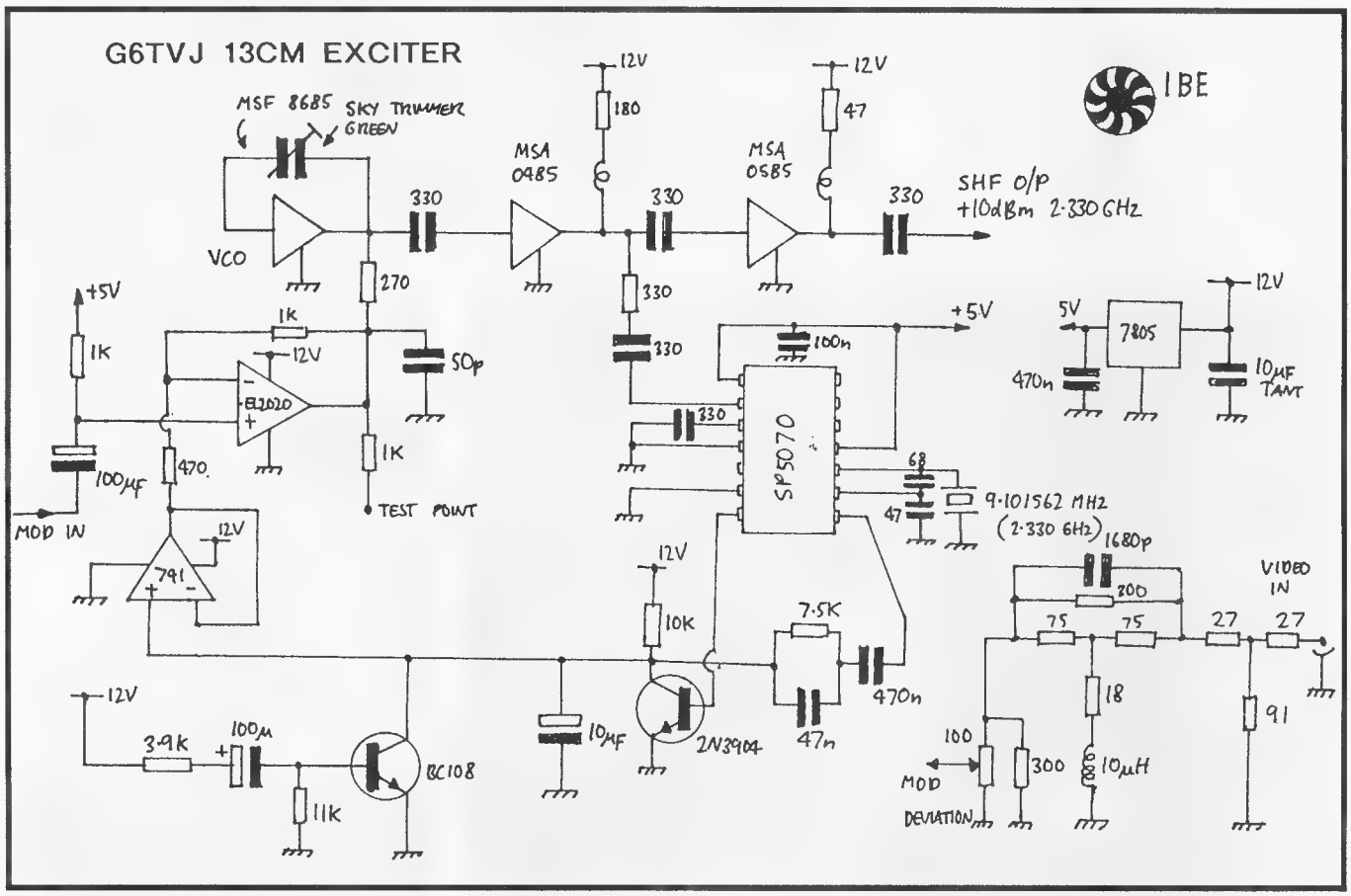

Fig 1 – G6TVJ 13 cm Exciter.

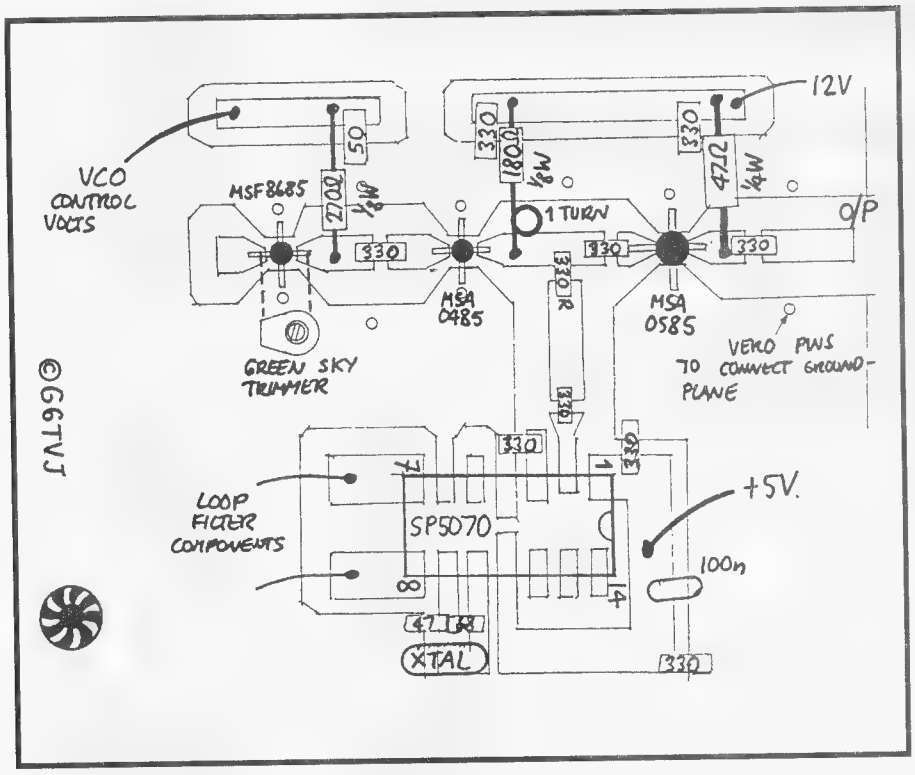

Fig 2 – Layout of critical components.

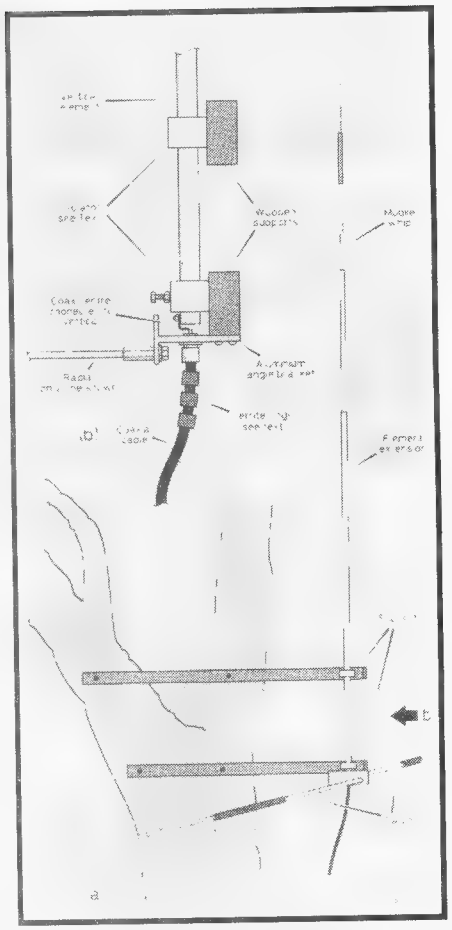

Fig 4 (a) General arrangement of 160 metre antenna. (b) Detail of fixing and connections.

of 38 mm diameter and 10 gauge wall thickness, and a 1.8 m top section of 28 mm 17 gauge aluminium. The total length of the lower aluminium radiator is just less than 6 metres. The joint was made by having a joining piece turned up, and the mounting plug at the top was also turned up to fit, at a local engineering works. The top 1.8 m tube was of a hardened aluminium alloy. The whips used were 2.4 m long so the total length of the radiator is around eight metres. The antenna is shown in Fig 4.

The radiator is mounted on two wooden supports. It is insulated from them by two blocks of Teflon or PTFE. The radials are fixed to a piece of Tee section aluminium which is attached to the lower wooden support. The weight of the antenna vertical radiator should be taken by a sheet of the Teflon or PTFE between the bottom of the radiator and the aluminium Tee section. The feeder connection should be waterproofed

The whole antenna should be mounted above head height. The original is shown mounted to a tree trunk but a post or the side of a building could be used.

The current on the outer of the coax should be suppressed by the use of ferrite rings or beads slipped over the feeder near the feed point. The antenna is not matched to the feeder at the feed point but is matched at the end of a short feed line in the shack. At 1.8 MHz most feed lines are short. The base impedance of the radiator is less than the cable impedance. The whips are resonated to the frequency of interest. The bandwidth is, of course, limited but it can be used over a slightly wider range by judicious use of an ATU. The original provided an SWR of 1.4 :1 at resonance.

*C/o PO Box 2175, Caulfield Junction VIC 3161

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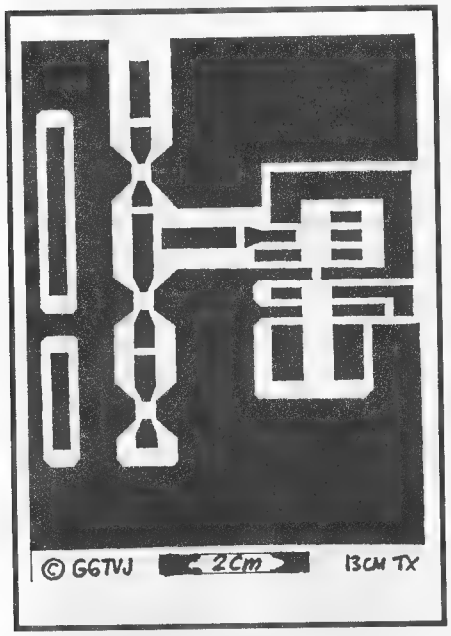

Fig 3 – PCB Layout (not to scale – use 2 cm bar to determine sizes).

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■ CD-ROM Review

ARRL Handbook CD-ROM Version 1.0 (one CD) *QST* View CD-ROM 1985-1989 (three CD Set)

Publisher: *The American Radio Relay League*

Reviewed by: *Peter Gibson VK3AZL*

In the March 1997 issue of *Amateur Radio* magazine, the CD ROM version of the 1995 editions of three of the ARRL's popular publications was reviewed. We have now had the opportunity to review two more offerings from the ARRL.

ARRL Handbook CD-ROM Version 1.0 (1997)

This publication includes all of the content of the paper-based Handbook whilst adding many additional features only possible with computer accessible information. It is laid out in the same order as the paper Handbook and is extensively indexed such that subject, titles, or even words can be used for a search. Frequently used areas can be book-marked and the history of searches or browsing is available for later study. The software that has been included in the back of recent Handbooks is also included on this disk.

The information is arranged in topics with internal and external linking to related topics and drawings. It is possible to zoom in on both text and drawings in each topic. Hardcopy can be produced on a printer connected to the computer.

Two nice touches on the CD are that many of the pictures are in colour and it is also possible to listen to sound samples where appropriate.

QST 1985-1989 CD-ROM

The important difference between this CD-ROM and the ones reviewed above (and last March) is that this one consists totally of scanned-in images. Whilst being perfectly useable, the images are not as sharp as on the other disks and, at worst, can require some interpretation.

In addition, the ability to search is not quite as extensive as the others, although it is still perfectly good enough for most purposes. It does not seem possible to search the advertisements. As well as being able to search for specific items, it is possible to browse from page to page, as in the real magazine. The images can be output to a printer connected to the computer.

In summary, both of these disks offer a very useful, compact and cost effective way of having a large amount of information at hand. In addition, it is in a form that allows it to be accessed easily. Can you imagine looking for an article in the 60 issues of *QST* represented by the three CDs?

Both disks are completely self contained and contain all of the driving software, but need Windows 3.1 or later as the operating system. They require an IBM/C personal computer with 8 Mbytes of RAM (the handbook can run with 4 Mb but prefers 8 Mb). Likewise, a 386 can be used for both, but a 486 or better is recommended.

A hard disk capacity of 14 Mb is needed for the *QST* CD and 6 Mb for the Handbook. At least VGA graphics of 640x480, 256 colour, is needed, with higher performance graphics cards looking even better. Obviously, CD-ROM drives are needed and a sound card is needed for the Handbook.

The review disks were provided by Daycom Communications and are both priced at $69. Very good value for money. **ar**

■ Filters

Constant-K Filters

Ian Berwick VK3ALZ discusses the assembly of the constant-K variety of filter and examines all the formulae required to build your own.*

Introduction

Constant-K Filters were pioneered by G A Campbell of Bell Telephone Laboratories circa 1920. The advantages they have include:-

1. the mathematics are easy to understand;
2. the power transmitted is limited only by the current and voltage ratings of the coils and capacitors; and
3. no special components are required.

The design formulae are given in most amateur radio handbooks (but without any theory); however, the theory is essential if one is to understand the design procedures.

Constant-K Filter

Standard circuits and notation:

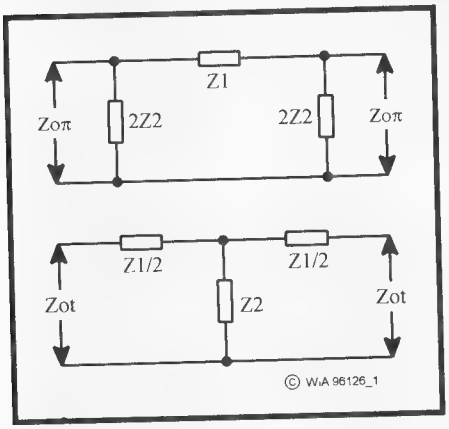

Figure 1

Note:

* The filters are symmetrical.

* The reactances of the series and shunt arms are of the opposite type.

* The product of the series and shunt reactances is independent of frequency; hence the name "constant-k".

For example, for the Pi-Section LPF, $Z1 = j\omega L$, $Z2 = 2 / j\omega C$. Hence, $j\omega L * 2 / j\omega C = 2L / C$ = constant.

Pi-Section

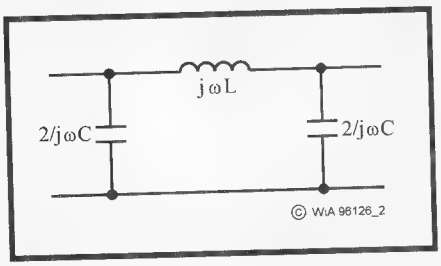

Figure 2

To find $Zo\pi$ in terms of $Z1$ and $Z2$:

We use $Zo\pi = \sqrt{Zsc * Zoc}$

$$Zsc = \frac{2 * Z2 * Z1}{2 * Z2 + Z1} \text{ and}$$

$$Zoc = \frac{2 * Z2(Z1 + 2 * Z2)}{4 * Z2 + Z1}$$

$$Zsc * Zoc = \frac{4 * Z2 * Z2 * Z1}{4 * Z2 + Z1}$$

$$Zo\pi = 2 * Z2\sqrt{\frac{Z1}{4 * Z2 + Z1}}$$

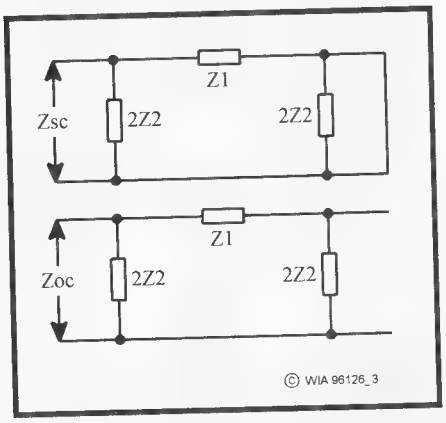

Figure 3

T-Section

In a similar fashion we can show:

$$Zot = \sqrt{Z1 * Z2(1 + Z1 / 4 * Z2)}$$

We proceed now to derive the cut-off frequency for the Low Pass and High

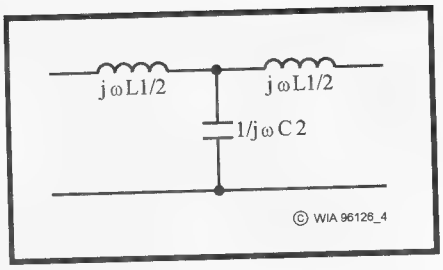

Figure 4

Pass T-Section filters.

Given that $\omega = 2\pi f$ radians per second (f in Hz),

$Z1 = j\omega L1$, $Z2 = 1 / j\omega C2$

(Note: j is the vector operator. = $\sqrt{-1}$).

Substitute in:

$Zot = \sqrt{Z1 * Z2(1 + Z1 / 4 * Z2)}$

We get

$Zot = \sqrt{(L1/C2)(1 - \omega * \omega * L1 * C2 / 4}$

Then

$Zot = 0$ when $\omega * \omega * L1 * C2/4 = 1$

This is the condition for cut-off.

Writing ωc for ω, we have:

$\omega c = 2 / \sqrt{L1 * C2}$

$fc = 1 / \pi\sqrt{L1 * C2}$

In a similar fashion we can show for the High Pass Filter T section:

$fc = 1 / 4\pi\sqrt{L2 * C1}$

The fc for the Pi section is the same as for the corresponding T section.

Low Pass T Section

Given $fc = 1 / \pi\sqrt{L1 * C2}$ and $Rk = \sqrt{L1 / C2}$, to find $L1$ and $C2$ $L1 = C2 * Rk * Rk$

$1 / L1 = C2 * fc * fc * \pi * \pi$

$C2 = 1 / (\pi * fc * Rk)$

$L1 = Rk / (\pi * fc)$

High Pass T Section

In a similar fashion we can show that:

$C1 = 1 / (4 * \pi * fc * Rk)$

and $L2 = Rk / (4 * \pi * fc)$

The L and C values for the Pi Section are the same as for the T Section.

The Variation of and with Frequency in the Pass Band

We know the Constant-K section is symmetrical. We can cascade T sections or Pi sections with perfect matching.

We would like Zot or $Zo\pi$ to equal Rk across the passband, but unfortunately this is not so.

For the low pass, Zot = Rk only at low frequency; likewise for $Zo\pi$.

For the high pass, Zot = Rk only at high frequency; likewise for Zoπ.

Zot and Zoπ are plotted against freqency in Fig X in the Appendix.

M-Derived Termination

To overcome the foregoing problem, the m-derived terminating half section was devised. We start by splitting a Constant-K Pi section in two to obtain an L network. This L network is modified as per Fig 5. With m = 0.6 this network has a Zin of Rk across most of the passband and a Zout of Zot. Therefore, it is a good termination for the constant-K T Section.

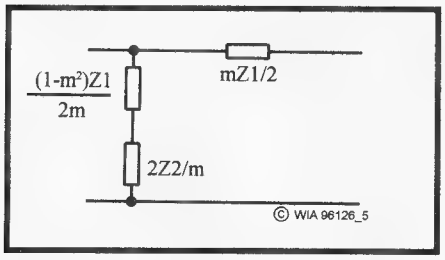

Figure 5

The composite filter is shown in Fig 6.

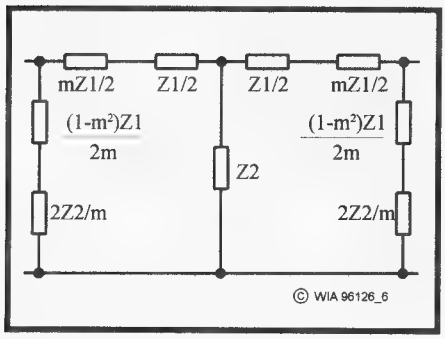

Figure 6

With m = 0.6 we have:

(1 + 0.6) * Z1 / 2 = 0.8Z1

(1 − (0.6 * 0.6)) * Z1 / (2 * 0.6) = 0.5333Z1

2Z2 / 0.6 = Z2 / 0.3

Redrawing the composite filter using these values we have Fig 7. For the Low Pass we get Fig 8 and for the High Pass, Fig 9.

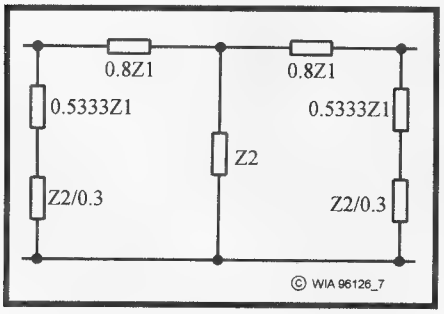

Figure 7

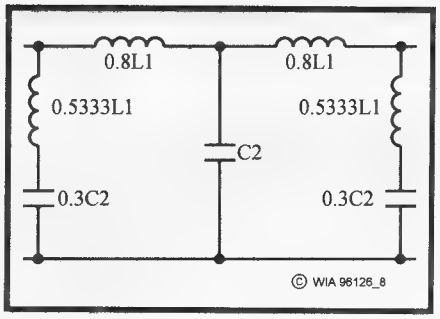

Figure 8

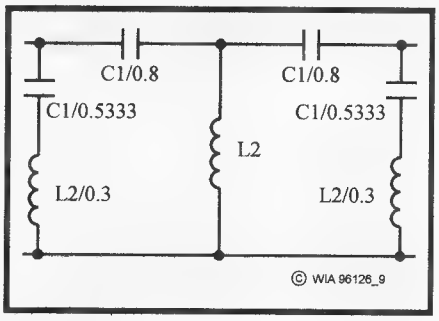

Figure 9

For transmitting we require two Constant-K sections. The filter is then as per Fig 10.

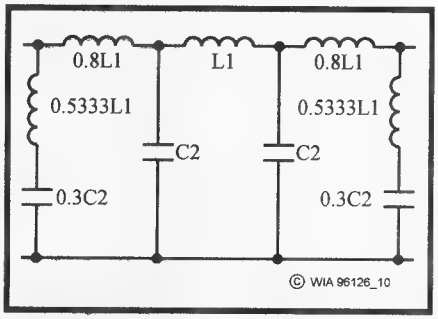

Figure 10

Steps in the Design Process

Assume the LPF, for example.

1. Given Fw (working frequency), compute Fc:

$fc = \frac{4}{3} * fw$ for LPF

$fc = \frac{3}{4} * fw$ for HPF

2. Select desired Rk, eg 50 ohms.
3. Compute L1, C2, 0.8L1, 0.5333L1 and 0.3C2. Double check your calculations when designing your own filter. This can save embarrassment later on. Follow through a worked example if in doubt.
4. Wind the coils – more on this later.
5. Make up the capacitors by series/parallelling standard values. Use silver mica for HF and plastic trimmers for VHF.

Assuming component accuracy to 5% is achieved, assemble filter and check VSWR (refer to Fig 11). Don't use the linear amplifier for a VSWR check as there will be harmonics present which will cause a VSWR error. The VSWR should be 1.1:1 or better.

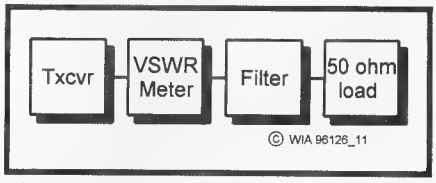

Figure 11

Worked Examples

1. Design a two section LPF with terminations for 160 m. Rk = 50 ohms, fw = 1825 kHz (refer to Fig 10).

$fc = \frac{4}{3} * 1825 = 2433.33$ kHz, say 2500 kHz.

L1 = Rk / πf c = 50 /(3.14159 * 2.5 * 10^6) = 6.3662 microhenries.

C2 = 1 / (π Rkf c) = 1 / (3.14159 * 50 * 2.5 * 10^6) = 2546.4 pF.

0.8L1 = 5.093 microhenries.

0.5333L1 = 3.3951 microhenries.

0.3C2 = 764 pF.

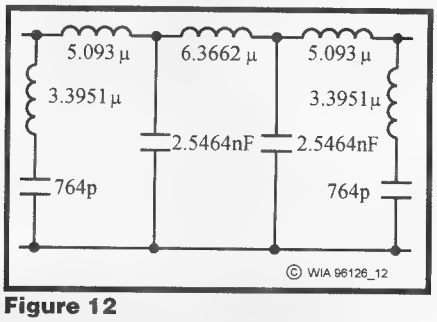

Figure 12

The series coils are wound on Amidon T200(2) powdered iron toroids with 16 B&S enamelled wire. The shunt coils are wound on Amidon T50(2) cores with 18 B&S wire.

Coil Winding Data

Coils are wound using the Amidon formula:

Turns = $\sqrt{L / (Al)}$ where Al is obtained from the Amidon data sheet (L is in microhenries).

For T200(2), Al = 120 and for T50(2) Al = 49. This gives the following result:

6.3662 microhenries = 23 turns

5.093 microhenries = 20.6 turns

3.3951 microhenries = 26.3 turns.

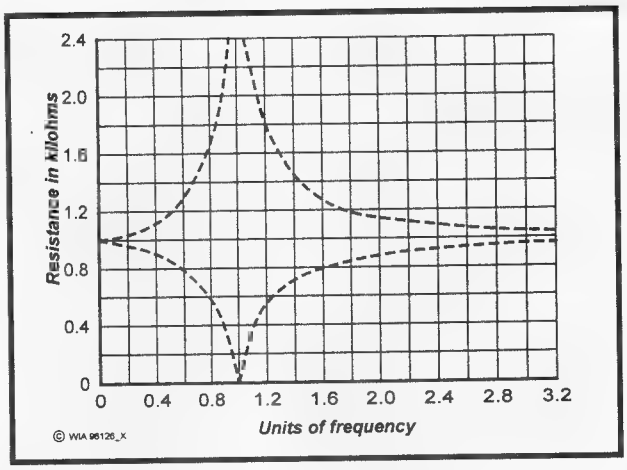

Figure X

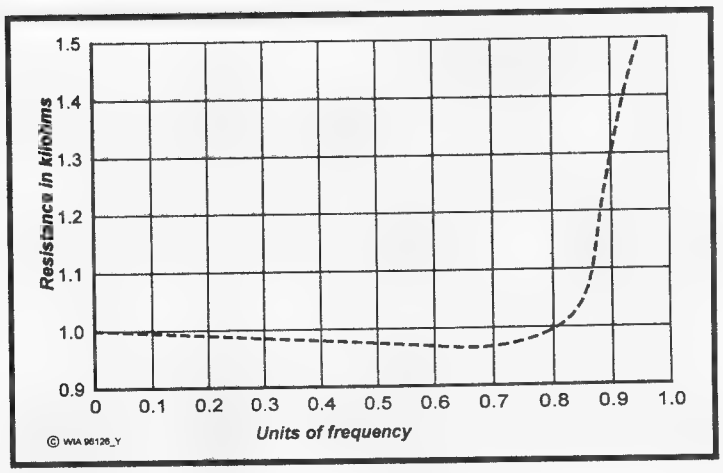

Figure Y

NOTE: For solid state linear amplifiers a separate LPF is required for each band.

The foregoing procedure can be used for higher bands just by changing fw and hence fc in the formula for L1 and C2. Use red mix (2-mix) core for 80 m, yellow mix for 40 and 20 m, and air wound coils for higher frequencies.

The Al values for yellow (6) mix are: T200 = 100; T50 = 40.

2. Design a LPF for a valve linear amplifier working in the range 1.8-30 MHz.

We can assume that the properly adjusted Pi tank will have sufficient harmonic attenuation in the 3-40 MHz range for the services operating therein. Our only worry is TVI, mainly to CH1 from 28 MHz and CH2 from 21 MHz. We choose an fc of 43 MHz, with Rk = 50 ohms. The circuit is the same as in example 1.

We compute the components as follows:

L1 = 0.37 microhenries

0.8L1 = 0.296 microhenries

0.5333L1 = 0.197 microhenries

C2 = 465 pF

0.3C2 = 139.5 pF.

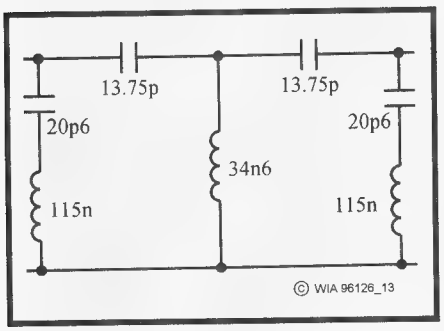

Figure 13

All coils are air wound, self supporting using 16 B&S. I use the inductance chart in the *RSGB VHF Handbook,* but other charts may work equally well. **NOTE!** Don't use this filter with solid state linears.

3. Design a single section HPF to eliminate interference in the 2 m band from a high power FM broadcaster (refer to Fig 9).

For the HPF we have:

0.8L1 becomes C1/.8

0.5333L1 becomes C1/.5333

L2 no change

L2/0.3 no change

Rk = 50 ohms.

Choice of fc:

Using $fc = \frac{3}{4} * fw$ we get $fc = \frac{3}{4} * 144 = 108$ MHz.

This is too low, so we choose 115 MHz.

$C1 = 1 / (4 * \pi * Rkfc) = 1 / (4 * 3.14159 * 50 * 115 * 10^6) = 11pF$

$L2 = Rk / (4 * \pi * fc) = 50 / (4 * 3.1459 * 50 * 115 * 10^6) = 34.6nH$

$C1 / 0.8 = 13.75pF$

$C1 / 0.5333 = 20.6pF$

$L2 / 0.3 = 115nH.$

Note: Mica capacitors are difficult to obtain in this country. The best source is: Communication Concepts Inc, 508 Millstone Drive, Beavercreek, Ohio 45434-5480, USA.

For Amidon Data sheets and cores, contact Amidon Inc, 3122 Alpine Ave, Santa Ana, CA 92704, USA.

The local Amidon suppliers have a limited range of cores, but some may be in short supply.

Conclusion

Other filters which can be designed using Constant-K technology are band pass and band stop filters. I can supply this information if needed. If required, the reference used for this article was *Alternating Current Circuits* by R M Kerchner and G F Corcoran, Chapter 9 "Electric Wave Filters".

Appendix

(A) Fig (X) Variation of Zot and Zoπ with frequency.

(B) Fig (Y) Zin versus frequency for m-derived half section.

(C) Attenuation in the stop band for a single section Constant-K LPF:

Where = $\omega o = 1 / \sqrt{L1 * C2} = \omega c / 2$

Angular Frequency (ω o)	dB
2	0
2.5	12
3	16.8
4	22.8
5	30.6
8	35.8

(D) Phase Shift

In the passband, phase shift is 0 degrees at DC, increasing to 180 degrees at cut-off. It remains at 180 degrees in the stop band. The filter is therefore unsuitable for base band video signals.

*107 Loongana Avenue, Glenroy VIC 3046

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Prevent pirates – make sure you sell your transmitter to a licensed amateur

ALARA

Sally Grattidge VK4SHE, ALARA Publicity Officer*

No News is No Good

Well, my *Amateur Radio* folder is almost empty this month so I will use that well-worn media trick of telling you what I have been doing and pretending it is news.

The method of gathering and moving information is slowly catching up with modern technology and the ALARA column now gets to Melbourne via e-mail which saves almost a week while chasing the deadline. News comes to me by e-mail, packet, telephone, mail and, yes, even occasionally by radio. Noise and distance make the Monday night net hard to copy and many good stories miss out on publication because important details are not heard.

Packet has problems too. Being out of town and therefore a weaker signal than most of the local users, I frequently get stuck (ignored) when there are several operators on the repeater. Not being blessed with endless patience I usually walk away when this happens, so messages are not read promptly. Packeteers, please send copy at least a week before the end of the month if possible!

I have joined, or tried to, the YL Packet net run by Phyllis KA1JC. This first venture into sending bulletins has produced some interesting results. At first I was unable to read the USA YL bulletins, but had some passed my way by an OM in UK! An ever-helpful local SYSOP e-mailed some to me but my computer refused to read them. When I finally got to see them listed, there were so many, I decided to read them later (which has not happened yet) and hope to find some interesting DX YL news among the chit chat.

Super (Souper) Gwen

Gwen VK3DYL won the VK Award in the recent WARO 80 m Thelma Souper Contest. Well done, Gwen! VK YLs really should make the effort to try this contest and support the ZL YLs the way they support us in the ALARA Contest.

Gwen is going to the CLARA GALA later in the year. After the Convention she plans to go to Churchill, Manitoba and observe polar bears from a Tundra Buggy with windows 10 feet above the ground, hoping she does not meet up with any 11 foot tall bears. Looking forward to some hair-raising yarns from that trip, Gwen.

That Crocodile Family - Bev VK4NBC and Graham VK4BGC

When the nice bright crocodile and the big green crocodile left for the ALARAmeet in Perth last year, Judy VK3AGC told them to leave room in the boot for a large box. When they met in Kambalda the box was handed over and found to contain a his-and-hers pair of concrete crocodiles complete with bathers and sunglasses!

These well-travelled crocs having been to Perth, around the south west corner of WA, across the Nullarbor and points north, now reside in Bev's Brisbane garden, adding to her considerable collection.

The Lament of a Roller Blader - Dot VK2DDB

Now I'm not what you would call one of the younger maids,

But still went out and bought myself some nice black roller blades.

I thought a practice on the flat was really quite sufficient

Because I skated when I was young and was generally proficient.

Up and down the verandah I skated with great glee,

Never even landed hard down upon one knee.

Then popped out to the carport without a worry or care.

It's all flat and well-swept so I felt safe out there.

Next to the turning circle and driveway with a slope.

Mmmm, I'm going faster, but not too fast I hope!

For fully fifteen minutes I criss-crossed about the drive.

The adrenaline was racing and I really felt alive.

Well my skating time was over so I made towards the door.

It was time to do the dusting and wash the kitchen floor.

My head was full of things to do as I rolled down one last time.

The next verse is the reason why I wrote this little rhyme!

As I nearly reached the house, I braked to slow me down

And stretched a hand out to the wall not to tumble like a clown.

Now the brake made one foot stop, with the other racing faster

And that is why I sit forlorn, with my left arm in plaster.

I've watched the children while they cook, and hang washing on the line,

I've told them what to pack for lunch, instructed how to iron

"Oh aren't you lucky it's not your right? Your left hand is it sore?"

"No not now, but I'm left-handed and use my southern paw!"

(some people will do anything to get out of doing the dishes)

**C/o PO Woodstock, QLD 4816*
Tel: 077 788 642
Packet: VK4SHE@VK4RAT.#NQ.QLD.AUS.OC
Internet e-mail: rgrattid@ozemail.com.au

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QSP News

Regulations Exams Papers

The SMA has advised that the content of the "Licence Conditions Determination for Amateur Operators" (LCD) has been released to the public by means of the Internet. It can be found at the ACA (SMA) Web site *http://www.aca.gov.au*. Photocopies of this document are available from the ACA State Offices.

As a result of this publication, the WIA Exam Service will start examining on the matters contained in this document as from 15 September (unless further delay is necessary for new papers to be approved).

* Examiners/invigilators are requested to refrain from ordering Regulations examination papers for one month to ensure a simple change over.
* Orders received before 15 August will be filled from the present bank.
* After 15 September, papers will contain questions on the updated conditions, frequencies, power and permitted modes.

It is expected that a revised version of the "Information for the Amateur Service" will appear on the above site shortly. At present, it is not expected that the above publications will be released in the brochure form with which we are familiar, but will be available from the Net or from ACA offices. This allows easier modifications if required.

Members who require a hard copy of the LCD are advised to obtain it from the nearest ACA office.

Further information will be published as it comes to hand.

AMSAT Australia

*Bill Magnusson VK3JT**

National co-ordinator
Graham Ratcliff VK5AGR
Packet: VK5AGR@VK5WI
E-mail: vk5agr@amsat.org
AMSAT Australia net:
Control station VK5AGR
Bulletin normally commences at 1000 UTC, or 0900 UTC on Sunday evening depending on daylight saving and propagation. Check-ins commence 15 minutes prior to the bulletin.
Frequencies (again depending on propagation conditions):
Primary 7.064 MHz (usually during summer).
Secondary 3.685 MHz (usually during winter).
Frequencies +/- QRM.
AMSAT Australia newsletter and software service
The newsletter is published monthly by Graham VK5AGR. Subscription is $30 for Australia, $35 for New Zealand and $40 for other countries by AIR MAIL. It is payable to AMSAT Australia addressed as follows:
AMSAT Australia
GPO Box 2141
Adelaide SA 5001
Keplerian Elements
Current keps are available from the Internet by accessing the AMSAT FTP site, *ftp.amsat.org* and following the sub-directories to "KEPS".

More Problems for MIR Operations

At the time of writing the MIR crew is in more trouble than Flash Gordon. A mishap in the form of a collision with a cargo ship caused some damage to solar panels and possibly to the hull itself. Although this incident happened during an experimental test of a new automatic docking apparatus, the potential for such a collision is always there. I recall Musa Manarov telling a story to a group of us in Melbourne a few years ago. He said that any docking is a dangerous procedure and when one was in progress the crew would retreat back into the escape module and were always ready to get away should a bad mishap occur. He called it his "Little Space-Ship". The current problems reflect this concern. A rescue mission and several space walks are planned; however, in the meantime power has been reduced on board MIR so amateur radio activity may take a back seat for a while.

International Space Station

Yes, folks, it's under way. The first bit, a 20 tonne pressurised module made in Russia, will soon be lifted into orbit by a Proton rocket from Baikonur. It will be joined by other units transported up by space shuttle and fitted into place by MIR Cosmonauts and Shuttle Astronauts. There are seven planned shuttle missions concerned with ISS in 1998 alone.

Of great interest to us is the amateur radio station which will be part of the ISS. At present, Canada, France, Germany, Great Britain, Italy, Japan, Russia and the United States have representatives on a planning board. Initially space on ISS will be limited but the planners have been allocated a full height, 19 inch standard rack and panel cabinet for equipment which will be housed in the "Hobby and Utilities" area. This area is available to all personnel on board ISS. This is a most exciting project and it will no doubt do its bit to ensure the survival of amateur radio space related activities well into the next century.

SPUTNIK-1 Flies Again?

I still remember that exciting day in 1957 when it was announced that Russia had launched the first artificial satellite, SPUTNIK-1. The signals were loud and clear on 20 MHz (the old Eddystone S-680-X, which still sits on my operating bench, was quite new then) and the "bip-bip-bip" was re-broadcast by just about every news agency in the world. Well, here we are some 40 years on and guess what? For the 40th anniversary of that historic launch, l'Aeroclub of France and the Russian Astronautical Federation are combining to produce a fitting commemoration. In the process they hope to excite the interest of as many young people as possible in space matters.

Pupils from two French schools are working on a replica SPUTNIK-1 miniature satellite. It will be hand thrown by a cosmonaut from MIR. The satellite body will be built in Russia and the transmitter will be made by the French pupils. When in orbit it will emit a bip-bip-bip similar to the original SPUTNIK-1, but not on 20 MHz. It will transmit on the 2 metre amateur band. Many schools world wide can gain access to 2 metre receiving equipment due to their association with amateur radio operators. It is planned that it will start operating on 4 October 1997. Its battery should give it a life of about a month.

Web Sites Contain Useful Information

Those with internet and world-wide-web capability may find the following web sites of interest:

http://www.grove.net/~tkelso/ for just about any kep element set you can imagine.

YOUR HOBBY — WIRELESS INSTITUTE OF AUSTRALIA — YOUR VOICE
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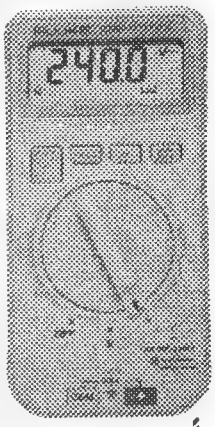
RECRUIT A MEMBER & THEY COULD WIN!

THIS GREAT **FLUKE 12B** *DIGITAL MULTIMETER* **WORTH $195**



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http://nssdc.gsfc.nasa.gov/spacewarn/spx511-glonass.html for information on new launches and decays and current situation.

http://www.physics.usyd.edu.au/~ptitze/vrml/vk2thn.wrl – Paul VK2THN informs me that he has established this site at Sydney University for space/astronomy related topics.

http://dhcom.com/astronomy/pathfinder.htm for images from the Mars Pathfinder probe.

Field Day operations via Satellite

I couldn't help noticing during the recent ARRL field day that there were dozens of stations operating via the digital satellites, mainly KO-23. Now this is no mean feat! I have often operated from mountain tops via various amateur satellites but never tried to get a digital station up and running on the mountain. When you reflect on the equipment requirements you can't help but admire those who put in the effort. Many (I'd guess most) of the field day stations were running WiSP as their software package. That would require at least a good lap-top computer or PC. One multi-band or two single band transceivers would be needed and the associated TNC/modem combination is a must. Then we come to the antenna system. I know from experience that simple antennas can work wonders from a remote location but I also know that many of the stations logged were running tracking antennas. More gear to co-ordinate. Tracking software and rotator interface units, etc all add to the complexity during field day operation.

I "dips me lid" to these heroes. In many cases it was a co-operative club effort but, club or single operator, either way it's deserving of admiration. Maybe one of these days on Mt Skene...hmmm.

Welcome Newcomers

Still on the subject of the digital birds, I noticed four new stations up and running this past month. Two VK2s, one VK3 and one VK4. Congratulations to all and welcome aboard!

AO-10 Visible!

Up there in the sky ... is it a bird? ... is it a plane? ... no! ... it's OSCAR-10! A rather remarkable piece of news appeared in a matter-of-fact way around the traps recently. I still find it astonishing even after several readings. This guy has actually SEEN OSCAR-10 in orbit. Read on.

Regular satellite users will be familiar with the fact that the keps for AO-10 have been somewhat out of date for some time now and several attempts have been made to update them by mathematical and other means. NORAD reported back in February that AO-10 had been in a difficult orbit to track optically for some time, hence the lack of new keps. A request was made to Paul Malay of the Johnson NASA space centre to have a look for AO-10.

Why Paul? It appears he's something of an expert at this business of tracking satellites visually. He scored a brilliant success with a video of the GALILEO spacecraft when it was some 600,000 km away. Yes, that's right, 600,000 km! Well, he was successful with OSCAR-10 too. He reported seeing it through 150 mm binoculars when at a range of 10,403 km. He could see seventh magnitude flashes diminishing to around ninth magnitude (that's very faint) over a period of 162 seconds.

He reported seeing nothing else in between the flashes in the way of background reflection, so presumably he was catching the sun glinting off the solar panels. He was splitting the difference between two sets of mathematically generated keps to do the observation and from his visual observation he was able to generate an even more accurate set of keps. So there you are. Next time you doubt that a set of keps is accurate, the answer is simple. Go outside one night and have a look! But don't try it unless you have all the good gear.

**RMB 1627, Milawa VIC 3678*
E-mail: vk3jt@amsat.org

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Awards

*John Kelleher VK3DP - Federal Awards Manager**

In an earlier publication of *Amateur Radio* I listed some thirty local Awards which had come under scrutiny, purely because they had been listed in an overseas awards directory and, to my way of thinking, needed to be revised to bring them up to standard.

The overall response was, in my impression, very poor. Some of the replies have subsequently been published, and I sincerely thank those who did reply to my request. It is still my intention to publish any or all local awards which appear on my desk.

On the international scene, the total of DXCC countries is reduced to 328 countries with the loss of VS6/VR2 Hong Kong. The situation in Zaire has yet to be resolved. The DXCC listings which follow will still include Hong Kong and Zaire. The February 1998 listings will, however, be complete. I am saddened by the fact that a recent operation from CY9 was aimed at northern hemisphere countries, with little opportunity for VK/ZL to participate.

The Blue Mountains Radio Club Award

This award is given for contacting any five club members on any amateur bands. Contacts may (but need not) include the Club Station VK2HZ. Log extracts verified by another licensed amateur are acceptable evidence of contact, subject to possible verification against members' log books. The award is free.

The Blue Mountains Amateur Radio Club holds weekly nets for members, and visitors are always welcome to join these nets every Tuesday night on 3.543 MHz, and every Wednesday night on the Club repeater on 147.050 MHz. Both nets commence at 2000 hrs local time, ie 1000Z in the Australian winter months, and 0900Z in the summer months. This information was supplied by Guy Fletcher VK2BBF, Hon Secretary, Blue Mountains Amateur Radio Club Inc, PO Box 54, Springwood NSW 2777.

Vanuatu Amateur Radio Society Award

This award is a standard size certificate printed in the four colours of the Vanuatu flag, and containing a scale map of the archipelago.

The award is offered to all licensed amateur radio operators and SWLs who qualify. To obtain this award, the applicant must have made not less than six (6) contacts with Vanuatu stations carrying the YJ8 prefix and who are members of the VARS. Note that YJ0 prefixes DO NOT qualify as a contact for this award.

Contacts made from Vanuatu Independence Day (July 30th 1980) are acceptable. Contacts may be made on CW, SSB, FM or RTTY. Two or more contacts with any one YJ8 station will be accepted, provided that these contacts are on different days, AND on different bands or different modes.

A log extract from the applicant, showing the contacts claimed, and duly certified by the signatures of two other licensed amateurs, will be accepted. QSLs are not required. This claim will be checked and confirmed against the logs of the YJ8 stations worked.

Endorsements are available for all one mode, one band, or additional stations worked. The fee for the award is $US2.00 or near equivalent, or 10 IRCs to cover International postage.

Please address all enquiries and submissions to: Awards Manager VARS, PO Box 665, Port Vila, Vanuatu.

This information supplied by Frank Palmer YJ8AA.

WIA DXCC Listings

Honour Roll – SSB

VK5MS	328/381
VK5WO	328/360
VK6LK	328/352
VK4OH	328/344
VK3QI	328/341
VK3DYL	328/333
VK5QW	328/333
VK3AKK	327/338
VK4LC	327/333
VK2FGI	327/332
VK6RU	326/380
VK4KS	326/372
VK6HD	326/350
VK4RF	326/344
VK1ZL	326/331
VK4UA	325/338
VK6NE	322/337
VK5EE	322/327
VK3AMK	320/338
VK2AVZ	320/330
VK7BC	320/329
VK3YJ	318/323
VK3CSR	317/325
VK2DEJ	317/322
VK4AAR	317/320
VK6VS	316/319

Honour Roll – CW

VK3QI	328/339
VK6HD	324/344
VK3XB	316/350

Honour Roll – Open

VK5WO	328/364
VK3QI	328/342
VK7BC	328/336
VK5QW	328/333
VK3AKK	327/338
VK6RU	326/380
VK4KS	326/372
VK4RF	326/361
VK6HD	326/351
VK4UA	325/340
VK3JA	324/327
VK3AMK	322/340
VK2AVZ	320/330
VK3XB	318/347
VK3OT	318/330
VK4AAR	317/320

Ordinary Listings – SSB

VK6AJW	312/317
VK6APK	311/315
VK5WV	307/326
VK6PY	307/312
VK3RF	304/311
VK6RO	302/307
VK3JI	298/312
VK4DP	294/305
VK3IR	295/298
VK2WU	292/296
VK4BG	287/302
VK3CYL	283/288
VK5OU	281/286
VK4OD	276/279
VK3VU	272/275
VK4SJ	268/...
VK3GI	264/267
VK3VQ	259/276
ZS6IR	259/262
VK5IE	259/261
VK3DP	257/260
VK4QO	251/255
VK6ANC	245/248
VK2PU	244/247
VK3UY	243/244
VK6YF	238/241
VK4CY	237/238
VK2CKW	234/237
PS7AB	233/237
VK4ICU	232/234
VK3DS	226/236
VK2ETM	226/227
VK3SM	222/242
VK5BO	218/222
VK3CIM	218/221
VK6APW	216/217
VK3DD	214/217
VK4LV	210/212
VK7TS	210/211
VK4XJ	204/216
VK3DVT	202/204
ON6DP	200/202
VK4KRP	199/201
VK2VFT	198/201
VK4BAY	190/192
VK4AU	190/...
VK6BQN	186/190
VK4IL	176/...
KA1TFU	175/178
VK4EJ	174/176
WA1MKS	171/...
VK2BQS	162/165
VK2NO	157/...
VK4IT	154/155
VK4CHB	152/153
VK4ARB	149/150
7J1AAL	149/150
VK4DMP	147/148
VK2SPS	141/143
VK3DNC	141/142
VK6LC	139/140
VK2EQ	139/...
VK6LG	135/...
TI2YLL	129/...
VK3DQ	127/141
YC8BWN	127/...
YC8EMH	126/127
VK6ABS	126/...
SM6PRX	124/126
VK3TI	122/125
HL4YD	118/119
VK4VIS	116/118
VK7WD	115/116
VK3BRZ	114/116
VK4NJQ	111/115
VK6NV	111/113
C21DJ	109/...
VK5GZ	108/110
VK2HV	108/...
JE9EMA	108/...
WA6NLJ	107/109
HC2HYB	107/107
VK5UO	105/107
VK4LW	105/...
N4JED	104/105
VK3EHP	103/105
JN6MIC	103/104
VK4BJE	102/104
KB2NEK	102/103
C21NJ	102/...
JH3OHO	101/103
VK2CMV	100/102
VK5CJE	100/102
VK6APH	100/101
ON4BCM	100/...

Ordinary listings – CW

VK5WO	312/327
VK4RF	306/332
VK3KS	303/330
VK6RU	275/319
VK3AKK	270/275
VK3JI	267/291
VK4LV	235/242
VK7BC	234/243
VK3DP	234/237
VK2CWS	233/235
VK4DA	221/223
VK3DQ	218/245
VK3EBP	210/212 (RTTY)
VK4ICU	208/...
VK4DP	205/216
VK3CIM	202/203
VK6MK	195/197
VK4OD	192/195
VK6PY	191/194
VK6HW	179/182
VK5GZ	175/177
VK4CY	172/...
VK5BO	159/184
VK5UO	156/157
VK3DNC	154/157
VK4XJ	150/163
VK7TS	147/...
WA5VGI	146/148
VK4UA	143/155
EA6AAK	138/...
VK7DQ	137/138
VK4AAR	131/133
VK4KS	127/135
VK2TB	123/125
VK3AGW	119/120
VK4CMY	117/119
VK2BQS	115/117 (RTTY)
SP1AFU	112/113
VK5BWW	110/111
VK6NV	109/110
OK1FED	109/...
VK5QJ	107/109
VK2FYM	**106/108**
VK8KV	**102/103**
VK8XC	**101/103**
VK3AMK	**100/102**

Ordinary listing – Open

VK3JI	311/319
VK4DP	310/323
VK6PY	309/316
VK6RO	308/313
VK3UY	308/310
VK3DP	303/307
VK4DV	300/314
VK4BG	294/312
VK4OD	287/290
VK3CYL	283/288
VK4CY	280/283
VK3VQ	274/291
VK5BO	264/301
TF5BW	260/264
VK4ICU	257/259
VK4LV	252/259
VK3CIM	252/255
VK6ANC	247/250
VK5UO	241/244
VK2CWS	239/241
VK2ETM	239/240
VK3DQ	233/262
VK4XJ	233/249
VK7TS	229/230
VK6APW	223/224
VK4DA	222/224
WA5VGI	216/218
VK2VFT	202/205
VK6MK	202/204
VK3DNC	185/187
VK5GZ	185/187
VK2BQS	176/179
PR7CPK	174/175
VK6NV	172/173
VK4CHB	160/162
VK2NO	158/...
VK8XC	150/152
VK6LC	142/144
VK2SPS	142/144
VK4NJQ	133/139
VK4EZ	129/138
YB8GH	127/129
VK3VB	126/128
VK4CMY	120/122
VK7HV	114/117
SP1AFU	114/115
VK2FYM	113/115
VK5BWW	111/112
VK2HV	109/...
VE7BS	106/107
VK3OZ	104/105
VK3COR	102/104
SM7WF	**100/101**

**4 Brook Crescent,*
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Phone (03) 9889 8393

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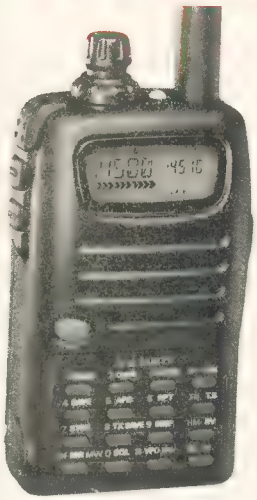
DICK SMITH ELECTRONICS

Great Savings On Communications



FT-10R 5 Watt 2m Hand-Held

A compact 2m hand-held with a unique clam shell design and rear-mounted NiCad battery pack that provides 5W RF output as standard through the use of a MOSFET power amplifier and extensive component miniaturisation. Built to a tough MIL-STD 810 rating for shock and vibration resistance, the FT-10R also uses gasket seals for improved weatherproofing.

Features:

- Tx 144-148MHz, Rx 140-174MHz
- RF Output: 5.0, 2.8, 1.0, 0.1W
- Dual watch facility
- Large Omni-Glow backlit display
- High efficiency speaker for super loud audio
- CTCSS encode/decode
- Auto battery save, Tx save & Auto power off for longer operating times
- 12V DC socket for charging and power
- Keypad frequency entry
- 99 memories
- Digital code squelch

Size: Just 62 x 100 x 42mm (WHD)

Comes with FNB-41 9.6V 600mA/H NiCad, A16D version keypad, belt-clip and AC charger.

Cat D-3650

STILL JUST $399

2 YEAR WARRANTY

YAESU

FT-900 Deluxe HF Mobile Transceiver

The Yaesu FT-900 is a revolutionary new 100W HF transceiver that answers the need for a truly practical mobile radio, but without the performance compromises of most micro-sized rigs when used in base station installations.

For convenient mobile operation, a lightweight front sub-panel with access to commonly used controls can be easily mounted away from the transceiver's body using an optional mounting kit. The large "Omni-Glow" backlit LCD screen provides high visibility over a wide range of viewing angles, while the voice and data between the sub-panel and the transceiver are digital to minimise RF feedback or noise pick-up problems. A tough diecast top panel/heatsink and duct-flow cooling systems allows extended transmission periods, while still allowing the optional ATU-2 auto antenna tuner to be mounted inside the transceiver.

Cat D-3280

2 YEAR WARRANTY

$1895

BONUS
Half-price ATU-2 auto antenna tuner when purchased with your FT-900. SAVE $249

FT-990 HF All-Mode Base Transceiver

We're overstocked on ex-demo transceivers, so take advantage of this opportunity to save on an excellent HF base-station rig! The FT-990 offers many of the features of the legendary FT-1000, only in a more compact and economical base station package. Together with clear front-panel layout and labelling, its large back-lit meter and uncluttered digital display allows for easy operation. The receiver uses a wide dynamic range front end circuit and two DDS to provide a very low noise level and excellent sensitivity over the 100kHz to 30MHz range. Transmitter output is 100W PEP on all HF Amateur bands (SSB, CW, FM) with high duty cycle transmissions allowed. The internal auto antenna tuner and an in-built power supply are standard features, while the customizable RF speech processor and switched capacitance audio filtering facilities are unique to the FT-990. Other features include IF Shift and IF Notch filters, IF bandwidth selection, 90 memories and one-touch band selection.

Cat D-3260

Clearance

Only $2495

2 YEAR WARRANTY

YAESU

FT-8500 Deluxe 2m/70cm Mobile

An exciting model from the Yaesu mobile lineup, the FT-8500 2m/70cm FM transceiver introduces the advantages of a large remotable Omni-Glow™ display with all major controls on an easy to use hand microphone, and MIL-STD 810C ruggedness. The FT-8500 provides three dual-band receive configurations (VHF+VHF, UHF+UHF, VHF+UHF), allowing cross-band full-duplex as well as standard single band operation. A unique Spectra-Analyzer™ with selectable channel and indicator widths shows station activity and relative signal strength above and below the current operating frequency or selected memory bank. Simple menu programming with alphanumeric labelling also covers most transceiver functions. Other features include 110 memory channels, inbuilt CTCSS encoder, a 1200/9600 baud data socket for Packet operation, Battery voltage readout, DTMF paging, and extensive scanning facilities. Supplied with MH-39 hand mic, DC power lead and instruction manual.

Specifications

Frequency Range:	Tx 144-148, 430-450MHz Rx 110-174, 300-500MHz
RF Output:	2m – 50, 10, 5W. 70cm – 35, 10, 5W
Sensitivity (Ham bands):	0.18uV (Main Rx), 0.25uV (Sub Rx)
Dimensions:	140 x 40 x 160mm (WHD)

Cat D-3318

2 YEAR WARRANTY

YAESU

SAVE $100 **$899**

2m/70cm Mobile Antenna

An easy way to go mobile, the new fibreglass M270 antenna with standard 5/16" thread can be used with existing base/lead assemblies you may already have in place on a vehicle. Constructed on a strong fibreglass rod and covered with long–life polyolefin heatshrink, this 975mm long antenna covers 144–148MHz and 430–440MHz with a maximum power rating of 200W FM.

Cat D-4808

MOBILE ONE **$34.95**

2m 1/2 Wave "On-Glass" Antenna

A high quality ground–independent mobile antenna that's easy to install without drilling holes. It's low–angle radiation pattern, slim radiator and an efficient coupling system provide excellent mobile performance. Provides 3dB gain, with power rating of 50W continuous (100W intermittent).

Cat D-4206

RFI **$99.95**

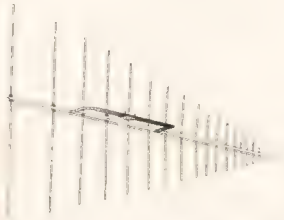
LP-1300 Log Periodic Yagi

The Maldol LP-1300 is a Log Periodic Yagi beam antenna designed to provide useful gain across the 100 to 1300 MHz range, making it ideal for scanner enthusiasts and ham operators who need a directional wide-band antenna. The LP-1300 consists of a 17 element Yagi with a special feed system that provides low SWR (less than 2.0:1) across the 100-1300MHz range, and can handle up to 500W FM when used for transmitting.

Gain:	6.0dBi to 10.0dBi (depending on frequency)
Boom length:	1.46m
Longest element:	1.35m
Weight:	2.3kg
Suitable mast:	28-60mm diameter (not supplied)
Max wind speed:	40m/sec
Connector:	SO-239

Cat D-4828

$249



Rugged HF 5-Band Trap Vertical Antenna

The rugged 5BTV incorporates Hustler's exclusive trap design (25mm solid fibreglass formers, high tolerance trap covers and low loss windings) for accurate trap resonance with 1kW PEP power handling. Wide-band coverage is provided on the 10, 15, 20 and 40m bands (SWR typically 1.15:1 at resonance, < 2:1 SWR at band edges) with 80kHz bandwidth typical on 80m at less than 2:1 SWR. An optional 30m resonator kit can be installed without affecting operation of other bands. High strength aluminium and a 4mm (wall thickness) extra heavy-duty base section guarantee optimum mechanical stability. At just 7.65m, the 5BTV can be ground mounted (with or without radials, although radials are recommended), or it can be mounted in an elevated position with a radial system. Unlike other antenna designs, the 5BTV can be fed with any length of 50-ohm coax cable.

Cat D-4920

HUSTLER

$349

30m Resonator Kit

Adds 30m coverage to the 5BTV, and includes all hardware.

D-4921 **$89.95**

B 2970

Offers expire 30/8/97

For further information, orders or the location of your nearest store call:

Ph: 1300 366 644 (local call charge)
Or Fax: (02) 9805 1986

DICK SMITH ELECTRONICS

Contests

*Peter Nesbit VK3APN - Federal Contest Coordinator**

Contest Calendar August - October 1997

Aug 2	Waitakere 80 m CW Sprint	(June 97)
Aug 2/3	YO DX Contest	
Aug 9/10	Worked All Europe CW	(July 97)
Aug 16/17	Remembrance Day Contest	(July 97)
Aug 16/17	Keyman's Club of Japan (CW)	(July 97)
Sep 6/7	All Asia DX Contest Phone	(May 97)
Sep 7	Bulgarian DX Contest	
Sep 7	Panama SSB Contest	
Sep 13/14	Worked All Europe Phone	(July 97)
Sep 20/21	SAC DX CW	
Sep 27/28	SAC DX Phone	
Sep 27/28	CQ WW RTTY DX Contest	
Oct 4/5	VK/ZL/Oceania DX Contest (Phone)	
Oct 5	RSGB 21/28 MHz Contest (Phone)	
Oct 11/12	VK/ZL/Oceania DX Contest (CW)	
Oct 18	Asia-Pacific CW Sprint	(Jan 97)
Oct 18/19	Worked All Germany Contest (Mixed)	
Oct 19	RSGB 21/28 MHz Contest (CW)	
Oct 25/26	CQ-WW DX Contest (Phone)	

Many thanks this month to HP1CDW, LA9HW, OE4BKU, PA3EBT, and *CQ*. Good contesting!

73, Peter VK3APN

Bulgarian DX CW Contest

7 September, 0000-2400z Sun.

This contest runs on the first Sunday of September each year on 80-10 m, CW only. Exchange RST plus ITU zone (P2 = 51, VK4/8 = 55, VK6 = 58, VK1/2/3/5/7 = 59). Score six points for each QSO with an LZ, three points for each QSO outside your WAC continent with a non-LZ, and one point for each QSO within your WAC continent. SWLs score three points if both exchange numbers are copied, and one point if only one exchange number is copied. Multiplier equals the total ITU zones worked on each band. The final score equals the total QSO points (all bands) times the total multiplier (all bands). Send logs postmarked within 30 days (Oct 1) to: Central Radio Club, Box 830, 1000 Sofia, Bulgaria.

Panama Anniversary Contest (SSB)

7 September, 0001-2359z Sun.

The Panama Radio Club invites all radio amateurs to participate in their 25th annual contest. The only category is single operator, SSB, all band 40/20/15 m. Exchange RS plus serial number. Score two points for QSOs with HP stations, and one for others. The multiplier is the total DXCC countries worked on all bands. Certificates of participation will be sent to all amateurs working 10 or more HP stations, upon receipt of three IRCs, and a plaque to the highest scoring station in each continent. Send log postmarked by 28 November to: Radio Club Panama Contest, Box 10745, Panama 4, Panama, or via packet to *HP1BYS@HP1CDW.PANCTY.PAN.CEAM*, or via e-mail to *hlewis@supremepty.com*

Scandinavian Activity Contest

20/21 September (CW), 27/28 September (Phone), 1500z Sat - 1800z Sun.

The CW and phone sections of this contest run on the third and fourth full weekends of September respectively, each year. The object is for amateurs world-wide to contact as many stations in Scandinavia as possible, on 80-10 m (no WARC bands). Scandinavian prefixes are: LA/LB/LG/LJ (Norway); JW; JX; OF/OG/OH/OI (Finland); OF0/OG0/OH0 (Aland Isl); OJ0 (Market Reef); OX; OY; OZ/5P (Denmark); SI/SJ/SK/SL/SM/7S/8S (Sweden); TF.

Categories (all band only) are: single operator; single operator QRP (max 5 W O/P); multi-operator single transmitter; SWL. Exchange RS(T) plus serial number starting at 001. For each QSO, score one point on 20, 15 and 10 m, and three points on 40 and 80 m. The multiplier is the number of *call areas* (0-9), not prefixes, for each Scandinavian country worked on each band. Portable stations without a district number count as area 0, eg G3XYZ/LA counts as LA0. OH0 and OJ0 are separate call areas. The final score is total QSO points (all bands) times total multiplier (all bands).

Use standard format for logs and summary sheets. Show duplicate QSOs with 0 points. Dupe sheets are required for 200+ QSOs. Forward separate logs for CW and phone sections. Logs on 3.5" DOS disk are welcome, and must be in ASCII, one QSO per row, and labelled with the call, contest name, section/s, and contest date. Include an SASE if you want your disk returned. Summary sheet must be on paper. The mailing address alternates between SSA (Sweden), NRRL (Norway), EDR (Denmark) and SRAL (Finland) in that order. For 1997, send your log postmarked by 31 Oct to: NRRL HF Contest Manager, Jan Almedal LA9HW, Tunet, N-1825 Tomter, Norway. Logs can also be e-mailed to: *sac@contesting.com*

CQ-WW RTTY DX Contest

27/28 September, 0000z Sat - 2400z Sun.

In this contest, the object is to contact as many stations world-wide as possible using digital modes (Baudot, ASCII, AMTOR (FEC & ARQ), packet) on 80-10 m (no unattended operation or operation through gateways or digipeaters), etc. Note new rule: all stations may now operate for the full 48 hours.

Categories are: single operator unassisted, single and multi-band; single operator assisted, all band; multi-operator single Tx, all band ("10 minute" rule applies to this category EXCEPT that one - and only one - other band may be used during the 10 minute period, if - and only if - the station worked is a new multiplier); multi-operator multi-Tx, all band. Single operator entrants can enter the low power section (up to 150 W) or high power (more than 150 W).

Stations may be contacted only once per band, regardless of the mode used. Send RST plus CQ zone; W/VE will send RST, state or area, and CQ zone. Count one point for each QSO with stations in your own country, two points for each QSO outside your country but inside the same WAC continent, and three points for each QSO with stations outside your continent. On each band the multiplier equals the sum of US states (max 48) and Canadian areas (max 13) *PLUS* DXCC countries (including W and VE) *PLUS* CQ zones (max 40). Note: KL7 and KH6 are claimable as country multipliers only, not state multipliers. Canadian areas are VO1, VO2, VE1 (NB), VE1 (NS), VE1 (PEI), VE2, VE3, VE4, VE5, VE6, VE7, VE8, VY. The final score equals total QSO points times total multiplier from all bands.

Submit a single summary sheet, including

scoring calculations for all bands, plus, for each band a separate log, duplicate check list, and multiplier check sheet. Send logs postmarked by 1 December to: Roy Gould KT1N, CQ WW RTTY Contest Director, Box DX, Stow, MA 01775, USA. A comprehensive range of plaques and certificates is offered.

Results of 1997 PACC Contest

(QSOs/mult/score)

VK8AV	78	23	1794
VK2APK	44	18	792
VK4XA	39	11	429
VK4ICU	9	6	54
VK4TT	6	4	24

1997 VK/ZL/OCEANIA DX CONTEST

Note: Rules are the same as last year.

DATE: This contest takes place each year on the first and second full weekends of October (Phone and CW sections respectively). For 1997, the dates will be:

Phone: 4/5 October 1997, 1000 UTC Saturday to 1000 UTC Sunday

CW: 11/12 October 1997, 1000 UTC Saturday to 1000 UTC Sunday

OBJECT: The object is for stations throughout the world to contact as many stations as possible in VK, ZL and Oceania (WAC boundaries apply), on 80, 40, 20, 15 and 10 m. Contacts between different countries in Oceania are permitted, but contacts within the same country are not permitted.

CATEGORIES: Single operator all band; multi-operator all band; and SWL. Single operator stations are where one person performs all operating, logging, and spotting functions.

EXCHANGE: RS(T) plus a three or four digit number starting at 001 and incrementing by one for each contact.

MULTIPLIER: On each band this is the number of prefixes worked on that band. A "prefix" is the letter/numeral combination forming either the first part of the callsign, or else the normal country identifier for stations using their home callsign in another DXCC country. For example, W8, AG8, HG7 and HG73 are all separate prefixes. The prefix for both N8ABC/KH9 and KH9/N8ABC is KH9. Portable designators without numbers are assumed to have zero after the letter prefix, eg N8ABC/PA becomes N8ABC/PA0. Any calls without numbers are assumed to have a zero after the first two letters, eg RAEM becomes RA0EM. Suffixes indicating maritime mobile, mobile, portable, alternate location, and licence class do not count as prefixes (eg /MM, /M, /P, /A, /E).

SCORING: For each contact score 10 points on 80 m; five points on 40 m; one point on 20 m; two points on 15 m; and three points on 10 m. The final score will be the total QSO points multiplied by the total number of prefixes worked. The same prefix can be claimed on different bands.

LOGS: Use a separate log for each band, with times in UTC. Show new prefix multipliers the first time they are worked. Logs should be checked for duplicates, correct points, and multipliers. Logs should be accompanied by a list of prefixes worked on each band, and a summary sheet showing callsign, name, address, category, number of valid QSOs, points and multipliers on each band, claimed score, and a signed declaration that contest rules and radio regulations were observed. Logs may also be submitted on DOS disk in ASCII format, although the summary sheet must be on paper. Comments and interesting anecdotes are invited.

SWL LOGS: SWL logs should show date/time, the callsign of the station heard, the callsign of the station being worked, RS(T) and serial number sent by the heard station, points claimed, and new multipliers.

LOG SUBMISSION: The mailing address alternates between NZART and WIA. For 1997, send logs postmarked within six weeks (24 November) to: VK/ZL/Oceania Contest Manager, c/o WIA, Box 2175, Caulfield Junction VIC 3161, Australia. Overseas entrants please use airmail.

AWARDS: Special certificates will be awarded to the top scorers in each category, in each continent, country, and VK, ZL, and JA call area. Where justified, single band awards may also be made at the discretion of the Contest Manager.

The CW entrant with the highest score will be awarded the Frank Hine VK2QL Memorial Trophy, and receive an attractive wall plaque in permanent recognition of his or her achievement.

DISQUALIFICATION: Entrants may be disqualified for taking credit for excessive duplicates, unconfirmed QSOs or other scoring discrepancies, or unsporting conduct. In matters of dispute, the Contest Manager's decision will be final.

**PO Box 2175, Caulfield Junction, VIC 3175*
pnesbit@melbpc.org.au

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Divisional Notes

Forward Bias – VK1 Notes

Hugh Blemings VK1YYZ

I'm pleased to report that the buy and sell/junk night was the usual success. I limited myself to an old UPS and some data books, thus leaving the shack no more cluttered than before. Other members didn't do so well, however, with one individual being seen to depart with a large number of diecast boxes, BNC connectors and other odds and ends to stock the junk box. Another stall selling all sorts of small signal components was also well patronised and was rather reminiscent of the 20 cent jars at milk bars of old.

The large turnout was particularly encouraging. If you're finding that the meeting topics as we organise them aren't meeting your areas of interest, please let the committee know what you would like to see and we'll do what we can to oblige!

There has been quite some activity on the contesting front this month with Jim VK1FF organising participation in the CW Australasian Sprint and IARU Contest as a Headquarters station. The hope is that both stations will draw on the expertise of a number of local amateurs operating under the call VK1WI.

Coming Events

Our August meeting will have a digital theme. We will be hearing about the Division's bit regenerative repeater which will be installed on Mt Ginini in spring of this year. This project promises to greatly improve the performance of the local packet network and the Packet Group have been going to some lengths to make this a facility accessible to all.

A second presentation will be on some unique packet software that uses the sound card in your PC as a modem and TNC. This is a great way to try your hand at packet with a minimum amount of fuss. Just install a cable from the sound card to your radio and you're ready to go. Doesn't get much easier than that! We'll have a live station operating so you can see it in action.

As usual we'll have coffee and tea available (we're working on cappuccino!). Look forward to seeing you there!

VK2 Notes

David Thompson VK2NH

Hello, again, as we enter wintery August. Depending on where you are it will soon be time, especially here on the east coast of Australia, to wind down your tower in preparation for the winds.

The VK2 Division President, Geoff McGrorey-Clark VK2EO.

Last month we told you about our new directors and the jobs they have to attend to. This month it is time to look a little more deeply at the man at the top in VK2, our President, Geoff McGrorey-Clark VK2EO.

Geoff first became interested in radio in 1978, when CB radio was first legalised, and says he worked his CB DXCC logging some 150 countries on 27 MHz. In 1986, while living in Melbourne, Geoff made friends with a Novice operator, Phil VK3PJZ, who he says helped him greatly. Geoff went on to get his full call in 1991, after sitting for the CW exam a few times. He then called in to the SMA, where he picked up the callsign VK2EO.

One of the main interests for Geoff is packet radio. He operates a Packet Bulletin Board and was President and founder of the Newcastle and District Packet Radio Group. He is also an avid DX chaser and can be found on all bands through 160 to 6 m, and as he travels around in his business. Most mornings he can be found mobile on 80 metres somewhere in northern New South Wales as he is travelling around with his business hat on.

Since becoming President of the VK2 Division, Geoff, who holds the portfolios of Chairman of the NSW Technical Advisory Committee and QSL Bureau Liaison Officer, says he intends to continue the good work by both Michael Corbin VK2YC and Peter Jensen VK2AQJ. In Geoff's own words *"The Division is running quite smoothly now and it is my intention to keep it that way. I see the Olympic Games as being our biggest challenge yet. It will put the VK2 Division and all VK amateurs firmly in the international spotlight."* Geoff went on to say that one of his priorities is to further increase membership of the Wireless Institute, NSW Division.

Geoff concluded by calling on all to join together for the betterment of amateur radio as a hobby. As you can see by the accompanying photo, Mr President does actually find time to sit down in the chair with his equipment.

Other VK2 Division News

The WIA (New South Wales Division) has decided to make a post office box available to those members who have suppressed details of their call signs and addresses in published call books. It has come to our notice that the Australian Communications Authority (ACA), formerly the SMA, is to publish on the Internet all callsigns and full details of licensed operators, including those amateurs who have requested suppression of details in the WIA-issued call book. If you're interested, contact the Divisional office. The post office box should only be used for amateur radio related mail, not as a general post box.

Last month I mentioned that we had held a celebratory day to mark the fortieth birthday of the Dural site to the north-west of Sydney. This is where we house our beacons and it is the station location for our Divisional broadcasts. It was decided by Council that fortieth anniversary certificates would be issued to those who have donated time or money to setting up of the Dural site, or who were present at the opening of the facility in 1957.

The response from those who have so far received these certificates has been very positive and believe me, on behalf of all in the Division, it is a pleasure to have been able to mark such an historic event in this way.

During July, I visited the Hornsby and District Amateur Radio Club monthly meeting to talk about the WIA, the present and the future (from a Divisional perspective). It was a very great pleasure to do so. Highlighted to me was the importance of promoting amateur radio, by simply talking to people and thereby spreading the good news. On the night I took along with me some "New Member Kits". If you know anyone who is a candidate for some information, contact our Divisional office and it will be arranged for a kit to be sent on.

If you would like to contact the VK2 Division regarding your hobby, please do not hesitate to contact the office or any of the Councillors. We will be only too pleased to hear from you. If you would like to get in touch with an individual Councillor, just contact our Divisional office and it will be arranged. Our free call phone number is 1 800 817 644 and our address can be found on page 56 of this magazine.

Next month we'll have more to report, but if you have anything you would like us to include as VK2 news, send it to me at PO Box 82, Springwood or by e-mail to *dthom@penrithcity.nsw.gov.au*

VK5 Notes

Ian Hunt VK5QX

Change, Progress and Communication

Last night I watched an historic event. This was the handing over of the Territory of Hong Kong from British authority to the administration of China. History was being made before our eyes and at the same time past history was vital to understanding of what was really taking place.

We need to recognise that change is an inevitable on-going process. We also need to understand the nature of these changes. I believe this is relevant to our hobby of amateur radio.

If ever there was a branch of technology that has shown constant change it is that of electronics and communications. Hardly a day goes by when we do not hear of some new development. A new approach to control or legislation often results. Community protests can result from such developments and changes.

What we need is a balanced understanding of how this affects us.

One aspect is modernisation of our equipment and techniques. Digital technologies have played a major part in our life from items such as programming of washing

machines to complete control, if desired, of our amateur radio station by computer – and all this at quite moderate cost. The costs in human terms can be great or small according to the wisdom applied in introduction of the technologies.

In encountering change we need to understand the realities it represents.

Not unlike Hong Kong, we have had administrative change in the South Australian Division of the WIA, ie a new Divisional Council. As with China, necessarily, people will be watching to see what we do. Only thoughtful consideration and supervision permits an organisation or a country to be run to the lasting benefit of all. Critical assessment of our leadership and decision making, can only be of advantage if problems are pointed out. So those in charge must be as aware of this as those watching.

Two way communication between those two groups must occur, and a spirit of trust must exist, otherwise chaos can result.

Harking back to technology, let us consider as one example the Internet.

To some this may be seen as a "monster" which is increasingly intruding into our lives. To others it can be seen as a major step forward and a great boon to society. I would suggest that the real answer lies somewhere in between.

But the inevitability of change does not mean that we simply have to lie down and accept whatever we are given. Each of us must find out just how we can utilise developments to our own benefit.

It may be coincidence that the major change taking place in personal international communications brought about by the Internet has occurred during the periodic and marked downturn in HF radio communications due to the effects of the sunspot cycle.

It has been said that we are losing more and more people from amateur radio to the Internet. Well, maybe. However, have you thought that here is an opportunity for people (amateur radio operators) to establish and strengthen ties with each other and, at the same time, spread the "gospel" of amateur radio before radio communication conditions improve out of sight.

The Internet provides a medium whereby our message can be spread. I am being naturally optimistic in taking this line. However, I am sure that the fascination of direct radio communication will result in an upsurge of interest by many who do not know about it now.

Likewise, by wisely utilising the new approaches in technology, as I have tried to show in this example, we can turn so many of these developments to our own benefit.

I am sure that many clever amateurs can look at what is being offered and from these produce effective strategies to guide the rest of us.

This does not mean that we ignore the history of the past. Past history is a very important component in considering the events which affect us all. To ignore lessons learned from experience is to fly in the face of danger. Balance is essential. A mix of the old and new, of youth and experience seems to me to be the most likely way to produce a very useful result.

Thus we can work to strengthen our hobby to benefit all. The desire of the South Australian Divisional Council is that we all work together towards this end. We ask only that you consider these matters and trust that, as a result, you will determine to support your Division in both word and deed. The hobby of amateur radio can certainly benefit from your acceptance and adoption of such ideals.

With this issue of the magazine, Divisional members will have received a copy of our bi-monthly Divisional Journal. In that insert you can read more about plans that the Divisional Council is making on your behalf.

"QRM" News from the Tasmanian Division

Robin L Harwood VK7RH

This month there seems to be very little news to report. Your Divisional Council was scheduled to meet on 19 July and a further report will be given in next month's column.

Last month, some vital work on the Mount Duncan site (VK7RMD) was done by Terry, VK7ZTI assisted by Alan VK7KAN. Others were also assisting and I believe even a helicopter was planned to be employed to bring in the heavy batteries. Our thanks to all who participated. Also the North-western branch has been conducting a raffle with a 286 as first prize.

The May meeting of the Northern branch had two interesting guest speakers. One was Doug Charlton VK7DK, who spoke on open wire feeders and antenna matching. Doug is active with the Australian Naval Amateur Radio Society nets on 14 MHz. The second speaker was Marcomm-Watson and was an interesting talk on satellite telephones. The latest handheld INMARSAT model was shown and it is very compact compared to earlier models. Not only does it handle voice traffic but is easily adaptable for FAX or e-mail. All one does is point it in the direction of the satellite, look at the pointers indicating signal level, and then dial your wanted number. The price of this model was just under $5,000. However, the minimum cost of a call was $1.99 per minute. One also had to dial your international code to first get into Australia. We could foresee that these phones could rapidly replace mobile phones in areas which are not at presently covered, for example the east coast and the rugged west coast or at sea. These models have world wide portability provided you have INMARSAT, yet there are blank spots to this world wide coverage, namely New Zealand and Antarctica.

Last month, the Southern branch WICEN group was involved in the Saxon Southern Safari Motor rally in the central highlands, providing vital communications. The North-western branch has also been involved in similar rallies over the past and some branch members will continue these in the future.

Our Divisional president has called on all Tasmanian amateurs to increase their participation in this month's Remembrance Day Contest. Last year, this Division won, yet there is room for an increased participation rate from all amateurs. Check out the rules in the July issue of *Amateur Radio*, and get organised.

Meetings for the month of August are: **South**, Wednesday, 6 August at 2000 at the Domain Activity Centre, Hobart; **North-western** Branch, Tuesday, 12 August at 1945, Penguin High School; and **Northern** Branch, Wednesday, 13 August at 1930, Launceston TAFE, Alanvale Campus, Block "C", Level 3.

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WIA News

New WIA Members

The WIA bids a warm welcome to the following new members who were entered into the WIA Membership Register during the month of June 1997:

VK2ARA	E C THRIFT
VK2BZA	P L H HILL
VK2FED	S NORMAN
VK2LK	B T TURNER
VK2DCA	A C M ANDERSON
VK2EMQ	J P MOODY
VK2XRA	A ROBERTSON
VK2AJF	J B FREEDMAN
L21050	R J BARNES
VK2DSO	D P WOOD
VK2JRL	R L TORV
VK2EZD	D DOWNIE
VK2AYC	J E COLLITON
VK2BVR	V A ROCHFORT
VK3TPJ	R HAMMENT
VK3AZE	C SALGER
VK3JAJ	A JUDSON
VK3HCD	A COLE

FTAC Notes

*John Martin VK3KWA, Chairman, Federal Technical Advisory Committee**

Six Metre Band Plan

I have received further comments on the 50 MHz band plan, which was discussed in my column in the March issue of *Amateur Radio*. Of the responses received, there is almost unanimous agreement that frequencies below 50.150 MHz should be kept clear for international DX and not used for local or regional operation. Other countries in Regions I and II have agreed on the 50.150 MHz dividing line, so it is logical for us to follow suit.

There have been some suggestions overseas to move the international DX calling frequency from 50.110 to 50.125 MHz. If this happens, we should again follow suit. But at least for now, the international DX calling frequency is unchanged at 50.110 MHz.

The upper half of the 50 MHz window, from 50.150 to 50.300 MHz, has plenty of room for contacts within Australia. There is strong support for the idea of adopting 50.200 MHz as the new calling frequency for contacts within Australia.

The suggested new band plan is as follows:

50.000 – 50.100	CW and Beacons
50.080 – 50.100	International CW only
50.100 – 50.150	International CW and SSB only
50.110	International DX calling frequency
50.150 – 50.300	Local and regional SSB
50.200	Local and regional calling frequency

With this plan, anyone trying to make or hear international DX calls could use 50.110 without interference from strong local stations. Also, anyone wanting to make local or sporadic E contacts would have a calling frequency which would not cause any clashes with DX operators. Everyone should be able to co-exist happily. It only takes a press of a button to scan the band or check the other calling frequency.

This proposal is now offered for final comment before being finalised and presented to Federal Council with a recommendation that it be formally adopted before next summer. Any comments would be appreciated by the end of August, by mail or via packet @ VK3BBS.

I would like to thank David McNaughton VK2BA for collating the opinions of a number of amateurs and passing them on to me. Written comments were also received from David Waring VK3ANP and Guy Fletcher VK2BBF.

160 Metre Band Plan

On a similar topic, I have had a number of responses to my comments on the 160 metre band plan. They fall into two groups. One view is that the existing band plan is satisfactory and should not be changed. One amateur pointed out that if any DX signals are heard around 1825 kHz, they have priority over any local contacts and the frequency is cleared.

I can't help but think that there might be some slips between cup and lip here. No-one would have to move if there was no local activity in the DX window in the first place. And I wonder how strong a DX signal needs to be before it can be heard underneath strong local signals.

The other viewpoint is best summed up in these excerpts from a letter from a VK6 amateur.

"For the past ten years, 1820 – 1840 kHz has been the de facto world-wide DX window for 160 m CW. Almost all countries with a 160 m allocation have their CW section in this window.

"Despite the generous frequency allocation for VK amateurs on 160 m, some insist on working SSB in this window. This operating habit is now confined to amateurs who operate from Eastern Australia. The individuals concerned regularly ruin CW DXing chances for those in the West – some unwittingly – by operating SSB in this portion of the band.

"With the exception of a few countries, 1840 – 1850 kHz serves as the phone DX window world-wide. This window is often used by amateurs rag-chewing with their mates, ruining the DX possibilities for amateurs in other parts of Australia.

"If only all VK amateurs would carry out local SSB QSOs above 1850 kHz. VK6 rag-chewers operate above 1860 kHz. It is time we fell into line with what happens on 160 m around the world and observed the internationally agreed DX windows."

It seems that it would be a good idea to make more use of the mostly empty space above 1850 kHz for local contacts, and leave the DX window clear for DX. The SMA ban on operation around 1870 kHz has been withdrawn, so the band is clear all the way to 1875 kHz.

In the current band plan, 1815 – 1835 kHz is shown as the "DX Window". This should be adjusted, and the band plan should also recognise the SSB DX window. This is the suggestion:

1800 – 1820	Local CW and FSK
1820 – 1840	CW DX Window
1840 – 1850	SSB DX Window
1850 – 1875	Local SSB, AM, fax, etc.

As an "easterner" and an occasional listener on 160, I realise that it may not be easy to change the operating habits of many years. But I think the attempt should be made, in the interests of a fair go for everyone.

This proposal is offered for any further comments, which would be appreciated by the end of August if possible. If there are no major objections I would suggest that it be formally adopted.

Long Delayed Mail

Several weeks ago I received a batch of mail, including letters posted as long ago as March. I am ploughing my way through them and should have responded to everything by the time this goes to print. But if you have written to me and received no answer yet, please bear with me.

Database Update

I am doing the annual update of the database of beacons, repeaters, links, and packet systems. Any additions, deletions or corrections to the lists in the last *Call Book* would be much appreciated. If you are the licensee of a beacon, repeater, or packet system, or if you have any information on what is operating where in your part of the country, I need it! Please post to me c/o the WIA Federal Office, or QTHR, or via packet: VK3KWA @ VK3BBS.

SSTV "Repeaters"

A new version of the SSTV program MSCAN allows an SSTV station to operate unattended and to automatically replay images received from other stations. There are now several stations running this system, which they call "SSTV repeaters".

There has been some uncertainty as to whether it is legal to run this kind of station unattended without a repeater licence. The answer is yes!

Clause 9 (1) of our Licence Conditions Determination allows us to operate an unattended station without a repeater licence if the station is under computer control and uses a store/forward mode. If the computer complies with the regulations on identification, retransmission and so on, the licensee does not have to be present. The best example is a packet BBS or digipeater, which can operate unattended without needing a repeater licence. A computer controlled station running MSCAN fits in the same category.

Clause 9 (1) is intended to cover stations using store/forward techniques. That means that the station does not automatically retransmit everything it receives: it stores the

data and forwards it later. This is the way packet stations operate, and an MSCAN station which retransmits a received image back to the originating station is operating in much the same way.

So, to get to the point. If anyone can operate an SSTV "repeater" without a repeater licence, why not a voice repeater? How about a dual band radio set up as a cross-band repeater?

The answer to that is NO. The fact that someone refers to a station as a "repeater" doesn't mean that it is one. An unattended packet or SSTV station is legal because it is NOT a repeater: it is a computer controlled store/forward station. If it was a repeater – a station that receives signals on one frequency and instantaneously retransmits them on another – it would need a repeater licence. So, there is no loophole here for unlicensed "private repeaters".

A final point on SSTV. Some Novices believe that it is legal for them to use SSTV. Not so! The SMA regulations include a list of the modes Novices are permitted to use, and SSTV is not in the list. If you are a Novice, don't believe anyone who tells you otherwise. Get a copy of the Licence Conditions Determination and check it for yourself!

*PO Box 2175, Caulfield Junction, VIC 3161

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Education Notes

Brenda M Edmonds VK3KT Federal Education Coordinator*

It was very pleasing to receive some comments on my last two columns, including ideas for school projects and support for the aims which I had stated. I would still like to hear from readers who may be able to give time to one or more schools, or who have ideas for ways to reach junior students.

Regulations Examinations

In my column in the February issue of *Amateur Radio*, I noted that I was hoping to receive news of the revised Regulations brochures. Unfortunately, there have been further delays. The SMA, very busy with the re-organisation involved in the changes required by the formation of the new ACA (Australian Communications Authority), has had to devote its time to the 98.5 % of its territory which is not related to amateur radio.

Mostly this does not affect amateur operators. However, it does cause a problem with the examinations of new recruits. All candidates must pass the Regulations examination to achieve a Certificate of Proficiency. But not all the material which is to be examined is available to either the candidate or the examining body.

The WIA Exam Service is still working from the Regulations question bank which was in place when the WIA assumed responsibility for the amateur examinations. A revised and extended draft question bank was submitted to the SMA for approval last year, but it cannot be finalised until all the revised brochures are available.

The operating conditions (including frequencies bands, power and modes for each type of station) are published in the "Radiocommunications Licence Conditions (Amateur Licence) Determination" (LCD) which, I understand, is available from the Internet at *http://www.aca.gov.au*. It is also available in hard copy from ACA (SMA) offices. A draft of the accompanying document, "Information for the Amateur Service", has reached the WIA, but it is not yet ready for public release.

To ensure a smooth changeover to the newer version, the *WIA Exam Service* is asking examiners/invigilators to refrain from ordering Regulations examination papers for a month (or until approval of the new papers is received). Orders received up until 15 August will be filled from the current question bank. After 15 September papers will contain questions on the contents of the above LCD.

Readers who require a copy of the LCD are advised to contact the nearest SMA office.

*PO Box 445, Blackburn VIC 3130

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How's DX?

*Stephen Pall VK2PS**

As I write these lines in front of my transceiver, my eyes are on the nearby TV screen. I am searching on 20 metres for VS97SAR. I want to work this station as the last one from British Hong Kong before midnight. No success. The operator of the Special Administrative Region amateur radio station – hence the suffix "SAR"- is probably watching on his own TV screen the proceedings of the peaceful hand-over ceremony of the British ruled Hong Kong to the Peoples Republic of China. Hopefully, I can catch the same station after midnight with the new prefix VR97SAR. Yes, the prefix of Hong Kong is now VR, and all the VS prefixes sooner or later will be changed over to VR.

Suddenly it dawns on me. What about the DXCC? Will Hong Kong continue to be a separate DXCC country after the unification with the Peoples Republic of China, or will the VS/VR2 prefix follow many others into the deleted countries repository?

I have a feeling that the DXAC is already working on this "diplomatically delicate" problem. Ever since the DXCC was caught in the controversy and diplomatic pressure of amateur and other interests by admitting Pratas Island BV9P, Scarborough Reef BS7H, and North Korea P5 (the latest with only a handful of contacts) into the DXCC countries list, the organisation has had "international headaches".

The fiasco about Romeo's XY0RR 1991 Myanmar activity, and the non-recognition of Mani VU2JPS's Andaman contacts, show the delicacy of the situation in which the DXCC finds itself today.

The first of July is also important not only because we start a new financial and taxation year, but because our master regulator, the SMA is no more, as such. The Spectrum Management Agency and the Telecommunication regulator AUSTEL were absorbed into the Australian Communication Authority (ACA), as from 1 July 1997. This means that the doors are open for total deregulation of the communication industry. Already there are pages and pages of newspaper advertisements announcing new telephone companies and the new discounted (mainly STD) rates.

I wonder in which way, and to what extent, this new change will influence the present and future of the radio amateur service. Hopefully, the new decision makers for the amateur service will have enough background knowledge about our hobby to make sensible decisions about the future of our service (it is more than just a hobby!).

Finally, did you notice that the day was longer on 1 July? Yes, longer by a full second. The "Sydney Morning Herald" quoted Dr Richard Brittain, the secretary of the National Time Committee, that a second was added to the world's time system known as Co-ordinated Universal Time. The second is added to keep the clocks in step with the Earth's rotation. UTC is measured by atomic clocks which are more constant than the speed at which the Earth rotates. According to these sources there have been 21 seconds added to the time system over the past 25 years.

We all know now why mankind lives longer. The secret is with the International Earth Rotation Service which is located in France. Au revoir!

Rashid A71AN and his German visitor Thomas DL9FCQ.

Willis Island VK9OC – 007

The Oceania DX Group has announced that it has organised a DXpedition to Willis island.

Willis Island lies about 300 miles east-north-east of Cairns, Queensland in the Coral Sea at latitude 16° S and longitude 150° E. It consist of a group of islets, the largest of which is occupied. The maximum elevation is 30 feet above sea level. The island is administered by the Australian Bureau of Meteorology and is manned by four bureau officers who spend a six months tour of duty there carrying out weather and other observations.

The expedition will depart Cairns on 9 September in the 60 foot vessel "Floreat". The journey to the North Islet will take approximately 30 hours, after which ten operators, and three tonnes of equipment (including 800 litres of petrol) will be unloaded for a 12 day stay. The group intends to set up two separate campsites with six complete HF stations and one station on six metres. They will carry with them 22 antennas hoping that there will be enough space to place them.

On the route back they intend to stop at Holmes Reef for a 30 hour stay before returning to the mainland. The DXpeditioners are three YLs (Ann WA1S, Elvira IV3FSG and 7K3EOP) and seven men (Jon K7CO/VK2DXT, OM3CUU/VK2AEA, Bob VK4MR, Eric FK8GM, AF7Y, AF7O, and Bill VK4FW. It is intended that they will be active on SSB, CW, RTTY, 10 metre FM and, hopefully, also on six metres, on the following SSB frequencies (all in kHz): 3620 (listening also 3785-3805 and 1900 for JAs), 7085, 14195, 14235, 14255, 18145, 21295, 24945, and 28480. The six metre frequency will be announced later.

For the USA the frequency will be 7150-7160. VK Novices: 3600, 21255, 3530, 21130 – 28130. CW 1810, 3505, 7005, 10103, 14020, 18070, 21020, 24895, and 28005. FM: 29200. RTTY: 14080, and 21080. Generally they will listen 5-10 kHz up.

All landing permissions have been granted and received. Donations and QSL cards to be sent to ODXG Willis Effort, PO Box 929, Gympie, QLD 4570, Australia.

Malyj Vysotskij Island OH5AB/MVI and R1MVI

I reported about this activity in the July issue of *Amateur Radio*. The disturbing news came after the deadline of this column. The group started operations as planned on 5 June but ran into many problems. The original landing dock used on previous occasions was unusable – it was destroyed. So was the old barrack building which the expedition intended to use for the two stations. They had to use ordinary tents as shelter.

The new landing place was quite a distance from the original one. The group was so exhausted after transporting all the gear over the distance that they slept through the first night. Generators were also a major problem, and it is suspected that the fuel which the group bought was contaminated.

Here on the east coast of Australia they had a very weak CW signal and were working USA on their short-path. The SSB station R1MVI had a better signal strength and was also working mostly the USA and the Middle-East. They left the island at 0330 UTC on 16 June after making 30,000 contacts.

North Cook – ZK1

The Date Line DX Association is in the final stages of planning an activity from North Cook Islands, specifically from Penrhyn Atoll OC-082, which will take place from 20 to 27 September. Priority will be given to low bands and the east coast of USA and Europe is targeted. Three radios will be operated, one of them for RTTY. The team is N7RO, N4RF, WA4YBV, KI6AN, K8XP, and Chris ex-ZS8IR. The team still needs another operator, someone with medical qualifications. Donations should be sent to WA4YBV, Robert Pond, 9 River Cove, Portsmouth, VA 23703, USA.

State of Qatar – A71

Some time ago I received a number of photographs, QSL cards and a nice letter from Rashid A71AN. As I held the envelope in my hand looking at the commemorative stamps reminding me of International Nursing Day, the question popped into my mind, where exactly is Qatar? Somewhere in the Persian Gulf, I thought. I quickly looked up my reference books. Here is the interesting background to the story of Rashid.

Qatar is a small Arab country on a desert peninsula that juts from Eastern Arabia into the Persian Gulf (25° N – 51° E). The area of the country is 11,000 square km. The greatest distances are, north to south 185 km, and east to west 89 km. People have lived in the area for thousands of years. It was only in the late 1700s that the variety of tribes became united under the Wahhabis, an Islamic sect from Saudi Arabia. The mid 1800s saw the Ottoman Turks taking over Qatar. During World War One it became a British protectorate (in 1916) and gained full independence in 1971.

The country is governed by an Emir with the assistance of a Council of Ministers and an advisory Council. Discovery of oil made Qatar a rapidly developing country.

Rashid A71AN is a relatively new amateur, licensed in July 1993. He enjoys amateur radio immensely and is often heard on the CW band segment. He uses a TS-850S and a TH-11DX antenna as his basic equipment. He is also teaching Morse code to intending amateurs at courses run by the Qatar Amateur Radio Society. According to the International Callbook there are now more than 50 amateurs licensed in Qatar and about 20 of them are very active on the bands in all modes including digital. Rashid lives in the capital city of Doha and he is the proud father of five children. He is also well known among visiting amateurs.

Future DX Activity

* The correct callsign of the Swedish operator from Taiwan who will be there until October is SM3SGP/BV2. QSL goes via SM3EVR.

* The IOTA (Islands-of-the-Air) contest will take place from Saturday, 26 July at 1200 UTC to Sunday, 27 July at 1200 UTC. This event will give many DXers the opportunity to work a few new countries.

* Sam is active from Riyadh, Saudi Arabia as HZ1CCA. He was heard on 7060, 21235 and 18135 kHz. QSL via K8PYD.

* Hiro JA6WFM is on the bands from Nicaragua as YN6WFM until December 1997. He was heard on 14190 around 2315 UTC. QSL via JA6VU.

* PA3AWN will be active in Ghana until the end of 1997 as 9G1AA. QSL to H V Dousterhoot, Bosbesplein 15, NL-3355 S G Papendrecht, The Netherlands.

* Charly OE3KLU and others from the ICOM-Austria Radio Club will be in Libya from 28 August until 7 September as 5A28.

* Jamal Al Maktoum A61AO is a newly licensed operator from the United Arab Emirates. QSL via KV5V.

* Mark La Point (ex-J5UAI) will be active from Yaounde, Cameroon, as TJ1US. He plans to be active on all bands on CW, SSB and RTTY. He is with the US Embassy for the next two years. QSL via NW8F.

* Steve 7Q7SB will return to Malawi in September or October and will stay there as a missionary for the next two to three years. QSL via AB4IQ.

* Unni LA6RHA will operate as JW6RHA from Svalbard Island from 14 to 29 August mainly on SSB. Check 7048, 14248, 21248, or 28448 kHz. Some of the activity will be battery operated so please be brief and exchange RST only. QSL via LA6RHA, Unni Gran, Mellomaasveien 128, N-1414, Trollasen, Norway.

* Christine, a YL operator, is active from Kiambu as 5Z4LL. She was heard around 1500 UTC on 18145 kHz. QSL via Box 14425, Nairobi, Kenya.

* Paul ZK2PJ and Janice ZK2JJ will be on Niue Island for the next two years. QSL via VK4AAR Alan Roocroft, PO, Dalveen QLD 4374.

Interesting QSOs and QSL Information

* TG9NX – Franco – 14164 – SSB – 0537. QSL via Callbook address or via, Francisco E Capuano N4FKZ, 2500 SW, 6th Street 501, Miami, FL-33135, USA.

* TK5BF – Jacques – 14203 – SSB – 0615. QSL via Jacques Godard, Alle du Maquis, Portigliolo, F-20138, Coti Chiavari, France.

* OH5AB/MVI – 14024 – CW – 1224. QSL via Orvo Arkko OH5NE, Muukko, Fin-53400, Lappenranta, Finland.

* Z32XA – Ozren – 14012 – CW – 0540. QSL via Mike Jakiela KM6ON, PO Box 286, Poway, CA 92074, USA.

* JY9QJ – George – 14028 – CW – 0546. QSL via Ullrick Helgert DL5MBY, Appenzeller Str 53, D-81475, Munchen, Germany.

* VP5/K5YG – Bill – 14205 – SSB – 0115. QSL via K5YG, via the QSL bureau.

* JT1FBB – Paul – 14192 – SSB – 1213. QSL via Sanford C Swartzendruber W9JOE, l6722, CO RD 40, Goshen, IN 46526, USA.

* YJ8UU – Stuart – 14164 – SSB – 0545. QSL via A E Law ZL2HE, 68 Ruahine St, Dannevirke, 5491, New Zealand.

* ZP70CM – Arthur – 14193 – SSB – 2239. QSL via Radio Club Loma Plata ZP1LL, PO Box 512, Asuncion, Paraguay, South America.

* SV5/HA4GD/O/P – 14013 – CW – 0630. QSL via HA4GD via QSL Bureau.

* OH0KMG – Antii – 14210 – SSB – 1214. QSL via Antii Nevantaus OH2KMG, Kartanont, 5 A 1, SF-00330, Helsinki, Finland.

* 5X4F – Paul – 14164 – SSB – 0555. QSL via James D Kulp K3SW, Signal Hill Farm, 88 Signal Hill Ln, Middletown, VA 22645, USA.

From Here and There and Everywhere

* A few issues ago I said that "Murphy never sleeps". He is still active! In the June 1997 issue of *Amateur Radio*, page 15, the photo referring to the St Peter DXpedition shows Mal VK6LC with another amateur

described as Neville VK5WG. The smiling face in the background is actually Paul VK5MAP and not Neville. Apologies to Paul VK5MAP and to Neville VK5WG for the mix-up.

* If you worked VI8NTD on 15 metres on 1 July 1997, it was Stuart VK8NSB assisted by Fred, a VK8 short-wave listener. Stuart was activating the special event station from Darwin celebrating self government in the Northern Territory which was granted in 1978. The activity was from 6 am local time until midnight on 21280 kHz SSB. Propagation was not the best, but Stuart still managed to work some good DX, such as 3W4EZD, V31PC, HH1A, VR97SAR and others on 15 m. A double sided QSL card will be sent to those who require it. QSL manager is Henry Anderson VK8HA, PO Box 619, Humpty Doo NT 0836 direct or via the bureau.

* The YJ8AA activity on Emai Island (OC-111)which was projected for early June, was postponed to the middle of July. The boat which was to carry them there needed further maintenance.

* It was widely reported in a number of DX Bulletins that Mani VU2JPS on Andaman Island had moved back to the Indian mainland as his tour of duty of three years had ended. He left the island on 12 June. After years of negotiations Mani finally received his modern equipment around Christmas time in 1996 by courtesy of HIDXA and Jim VK9NS. Unfortunately, his activity was not accepted by the DXCC desk due to some missing paperwork.

* The two Macquarie stations, VK0TS and VK0GW, have been active from time to time on the 80 m phone band talking to their friends in VK. VK0TS has skeds on Tuesdays and Wednesdays and sometimes even on weekends on 14222 kHz. Jim VK9NS is the net facilitator.

* Had a very pleasant, long QSO with Paul JT1FBB who was 59 plus in Sydney. Paul is an American electronics engineer with Mongolia's first commercial TV station which is a joint venture between the Mongolian Broadcasting Corporation and American interests. He is on a two year contract and his amateur station is located in the TV station building using a TS-445S and amplifiers with a 1500 W PEP output to a vertical Antenna. The TV station plays a lot of sports programs including even an occasional Australian rules football match. Paul mentioned that from 8 to 13 July a joint Mongolian American DXpedition was to be active from the northern edge of the Gobi desert at Juulchin. The station probably used the JT4 prefix.

* The ANARE (Australian National Antarctic Research Expeditions) celebrated 50 years of Antarctic activity with a number of mid-winter parties on all ANARE bases including Macquarie Island. It was reported that Tom VK0TS had made about 300 QSOs so far, and Graham VK0GW had about 90 contacts.

* Bill VK4UA is temporarily off-air as his antenna suffered major accidental damage during maintenance. Fortunately Bill was not injured.

* "Dusty" ZL2VS, the well known DXer and IOTA Chaser has been in hospital for a major operation. He is now slowly recovering at home.

The TH-11DX antenna system at A71AN.

* Nabil OD5NA is often heard on the bands. His QSL manager is Veronica Della Dora IK3ZAW, Piazza Flume 14, I-30126, Lido Di Venezia, VE Italy.

* Special event station VU4NG97 celebrated the 4th National Games of India.

* Alain (ex-5U7NU, TZ6NU and XT2BR) is now active as Z21KM from Zimbabwe. It is possible that he might be active from Zambia as 9J1AE or from Malawi as 7Q7/9J2AE. QSL via F6FNU.

* There has been a reorganisation of the Taiwanese prefixes. Here are the changes: BO1xx, Matzu Island; BO2xx, Kin Men Island; BO2YA, CTARL (Chinese Taipei Amateur Radio League) Kin Men Island club station; BV0xx, special event stations; BV1-8xx, Taiwan areas; BV9, islands near Taiwan; BV9A, Penhu Island; BV9O, Orchid Island; BV9G, Green Island; BV9P, Pratas Island (DXCC country); BV1-8Yx, CTARL Branch club stations; BV9AYA, CTARL Penhu Island club station; BV4YL, CTARL YL/XYL club station, mid Taiwan area; BV2Y, CTARL Taipei office station; BV5Y, CTARL HQ station. The address of the BV QSL Bureau is PO Box 73, Taipei 100, Taiwan.

* HB6FG is a special call activated by Cedric HB9HFN in celebrating the 60th anniversary of the Fribourg Section of the Swiss Ham Radio Association (USKA). QSL via HB9FG or via the Bureau.

* LY97XA was a Lithuanian station celebrating the 300th anniversary of Vilkaviskis town.

* The DXCC desk has announced that the number of unprocessed applications at the end of May 97 was 350 (28,736 QSLs). The total number of applications during May was 443 which shows an increasing trend against the April total of 313 applications and the March total of 322 applications.

* The correct QSL manager for Den A35DB is W7TSQ and not W7SNH as reported in some other publications.

* The address of the Moldavian National QSL Bureau has been changed since 15 April 1997 to: National QSL Bureau of Moldavia (ARM), PO Box 9537, Kishinev, MD-2071, Moldova, Europe.

* Stuart YJ8UU is working for the Vanuatu Civil Aviation Authority for the next two to three years. He intends to operate from 2 to 160 metres once all his antennas are in place. He is constructing his 6 m antenna now, and soon will construct several other loop antennas, one specially for 2 metres. His QSL manager is ZL2HE, and he requires two IRCs for a reply.

* To celebrate the 100th anniversary of Belo Horizonte City the special event station ZW100BH will be active until 14 December on all bands and all modes. QSL via PY4AA, LABRE/MG PO Box 314, Belo Horizonte/MG, 301323 – 970, Brazil.

* VK0IR is the title of the book which is the story of the recent Heard Island DXpedition. The book is hard cover, contains 224 pages (not 192 as indicated earlier) and has many excellent colour photographs. It also contains a list of financial support donors. Whilst the author of the book

(KK6EK) acknowledges that the list is not complete and contains only those donations which arrived before the printing deadline (15 April), the lack of VK/ZL support is remarkable. I could detect only two VK amateur clubs, one individual donation from VK5, one individual donation from VK8 and one individual donation from ZL. Out of the seven WIA Divisions only the New South Wales Division (VK2) supported the expedition. If you want to order the book, contact the Heard Island Expedition, Locked Bag 29, PO Rydalmere NSW 2116 (see my June '97 column for details).

* The Polish special event station 3Z2GD was active during July celebrating the 1000th anniversary of Gdansk city. QSL via SP2FOV.

* Mats SM7PPK is in Uganda working for the United Nations. He received his Ugandan licence with the call 5X1Z. He is currently working on his antennas; the first one to go up will be probably on 40 metres. Mats is a keen CW operator so there is the opportunity for the CW enthusiasts to secure this country on their favourite mode. QSL via Mats Persson SM7PKK, Zenithgatan 24 #5, SE-212 14 Malmoe, Sweden (new address).

* HG5UFO was active from Hungary during the June celebration of the International Exhibition of Space in Budapest. QSL via PO Box 17, Budapest 1456, Hungary.

* It is nice to be remembered. I received a short note from Warren VK4WH (formerly VK0WH) thanking me for the articles and news which I published in my column about his activity whilst he was on Macquarie island.

* Ken VK5QW was in hospital in Adelaide for a complicated surgical procedure. I am sure he will be happy to receive your get well cards. His many friends wish him a speedy recovery.

QSLs Received

J77FT (1 m – PO Box 1421, Berlin 14004, Germany); 9M6TPR (2 m – KQ1F); FS5PL (2 m – KF0UI); CO8LY (2 m – op); 3B8/IK2GNW (4 m – IK2GNW); A71BH (6 w – OE6EEG).

Thank You

Many thanks to my amateur friends whose assistance is a great help in compiling these notes. Special thanks to: VK2XH, VK2KFU, VK2TJF, VK4WH, VK5MAP, VK5WO, VK8NSB, YA8AA, YA8UU, JT1FBB, A71AN, KK6EK and the publications *Sydney Morning Herald*, *Oceania DX Group*, *QRZ DX*, *The DX News Sheet*, and the *425 DX News*.

*PO Box 93, Dural NSW 2158

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Novice Notes

*Peter Parker VK1PK**

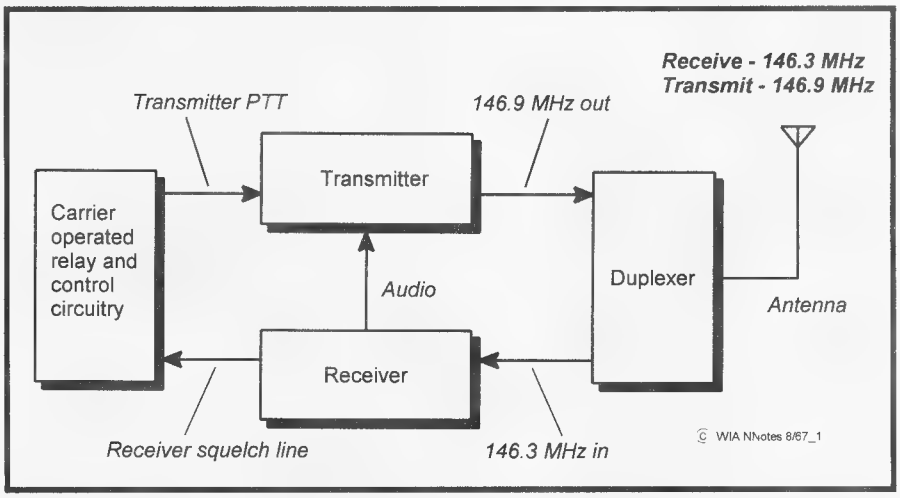

Fig 1 – Block diagram for a two metre repeater operating on 146.900 MHz (6900).

Voice Repeater Basics

Repeater operating is one of the most popular facets of amateur radio. For the Novice Limited licensee, restricted to 30 watts on 2 m and 70 cm, repeaters offer a means to make longer distance VHF/UHF contacts, especially when operating mobile and away from home. This article looks at the technical aspects of amateur voice repeaters; other topics such as equipment and operating procedure were covered in October 1995's column (Ref 1).

Introduction

Voice repeaters extend a station's transmitting range by receiving incoming transmission and simultaneously retransmitting them on another frequency. They consist of a receiver, transmitter, filter, antennas and timing/control circuitry. Repeaters are normally situated on hill tops or high buildings for best coverage of a particular area.

Operation

Repeaters use two frequencies; an input (or receive) frequency and an output (or transmit) frequency. These frequencies are 600 kHz apart for two metre repeaters and 5 MHz apart for repeaters operating on 70 centimetres.

For a repeater to transmit, it needs to be activated by a sufficiently strong signal on its input frequency. The presence of such a signal activates the repeater's squelch or mute circuit. This causes the repeater to start transmitting. The audio from the receiver is fed direct to the transmitter. The result is that, for as long as there is a strong enough signal on the repeater's input, the transmitter is activated. Those listening to the repeater's output frequency will then hear a stronger, re-transmitted version of the signal on the input. Fig 1 shows a block diagram for a basic voice repeater.

Repeater Equipment

Ex-commercial VHF FM transceivers, such as the Philips FM 828, are often used in amateur repeaters due to their low cost, good performance, and easy availability. Depending on the availability of power at a repeater site, wind, solar or 240 volt mains may be used to run the repeater. Rechargeable lead acid batteries are often used to provide backup during power failures. Because their receivers are operating 24 hours per day, even very quiet repeaters draw appreciable amp-hours. Antennas used in repeaters must be built to withstand adverse weather. This is because access to a site may be difficult or time-consuming, particularly if it is shared with other users or is in a remote location.

Desensing

The main difficulty when designing a voice repeater is the closeness of the transmit and receive frequencies. This small difference makes it very easy for the repeater's receiver to be overpowered (desensed) by the strong signal from the repeater's own transmitter. Failure to cure this problem makes the repeater unable to receive weak input signals. Repeater builders separate the transmit and receive antennas and install banks of cavity filters before the

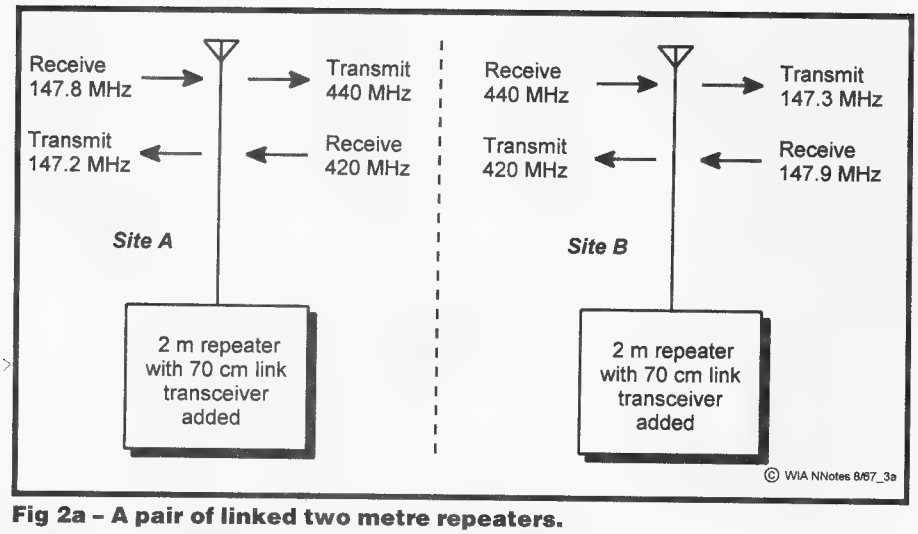

Fig 2a – A pair of linked two metre repeaters.

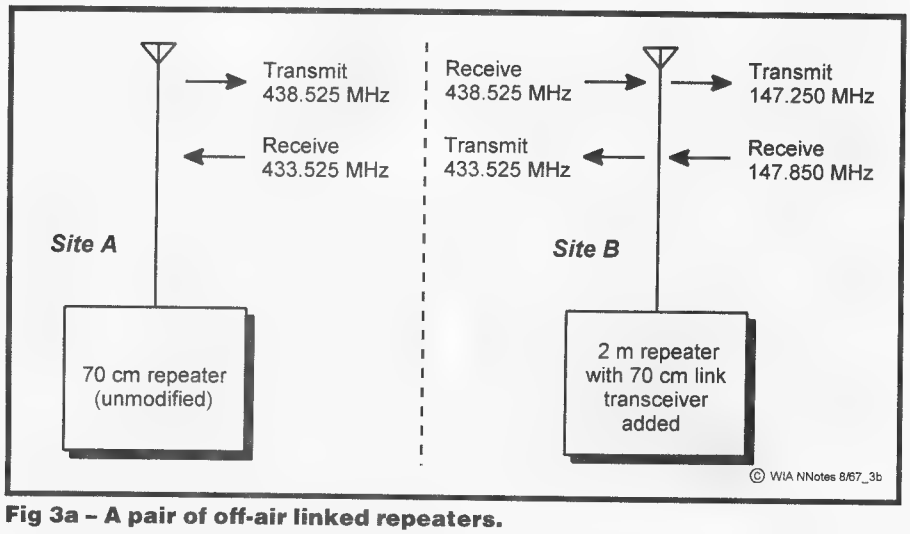

Fig 3a – A pair of off-air linked repeaters.

repeater's receiver and after the transmitter to eliminate desensing.

Cavity filters are simply very sharp (high Q) tuned circuits. Depending on how they are connected, they can be made to act like band pass or notch filters. The notch filter connection is used when you want to attenuate deeply signals on a particular frequency, but want little attenuation of signals on other frequencies. This would be useful at a repeater's receiver, where it is important to attenuate the signal transmitted by the repeater's transmitter (to prevent desensing) but allow good sensitivity at the repeater's input frequency.

Repeater Control and Timing Systems

As well as transmitting, receiving and filtering equipment, repeaters include timing and control circuitry. The sophistication of this varies between repeaters. The following are some functions performed by these circuits:-

* Voice or Morse identification;
* Time-out (repeaters may not transmit for more than 10 minutes continuously);
* Fault protection (shuts down the repeater if it develops a fault);
* A "tail" (this keep the repeater transmitting even when a station's signal temporarily drops below the repeater's receive threshold);
* Sub-tone encoding of the repeater's transmissions to reduce the effect of pager interference to suitably equipped users; and
* Accessing links to other repeaters.

Modern repeaters use a control board featuring an EPROM microprocessor IC to perform many of these functions. By programming this chip, repeater builders can customise the functions provided to suit their needs.

Repeater Access

Most repeaters are open access. This means that a carrier signal on the right input frequency is all that is required to operate the device. However, a few repeaters are "closed", that is they require special tones to be transmitted before they will operate.

For example, a UHF repeater may include a user-controlled cross-band link to a repeater on 29 MHz FM. By transmitting a suitable tone to activate the link, the user can enjoy contacts on ten metres FM, even though they themselves do not possess HF equipment. Signals with no access tone will be retransmitted on the UHF repeater output only.

Where a repeater is installed near high-powered VHF or UHF transmitters, it may continually be triggered by spurious signals or mixing products. Making the repeater's mute tone-activated means that only amateurs sending the required tone can open the repeater. This makes monitoring the repeater more pleasant – an important consideration given that far more people listen to repeaters than actually talk on them!

Repeater builders may have other reasons for making their repeater tone access only. The frequencies of the tones used by these repeaters are given in the repeater section of the *Australian Call Book*.

So what are the main ways to control access to a repeater or repeater link? There are at least three methods. These are as follows:-

Tone-burst. Requires users to transmit a short 1750 Hz tone to open the repeater. Usually an audio oscillator on the correct frequency is required, although a high-pitched whistle may do the job. This system is technically primitive, unpleasant to the ear and is not used in Australia. However, because it is common in Europe, many rigs have this feature built in. Owners of such rigs can be recognised by the very annoying high-pitched squeal at the start of each of their transmissions. If you have such a rig, do your fellow amateurs a service and ensure that this facility is disabled each time you transmit.

CTCSS sub-tone. This stands for Continuous Tone Coded Squelch System and is more advanced than the tone-burst system. Tones are transmitted continuously and are at frequencies below those of the human voice, so that their presence does not disrupt communication. A choice of standard tones gives the system greater versatility than the tone-burst system. Typical applications include reducing the effects of 148 MHz pager transmitters on two metre receivers, activating links for WIA broadcasts and cross-band repeater linking. Many modern VHF/UHF transceivers include this facility as standard.

DTMF. Dual Tone Multi Frequency. A similar system to that used in modern tone-

dial telephones. Each number has a unique combination of two tones. Useful for remote control of repeater sites due to the large number of combinations possible. DTMF may also be used for activating links to other repeaters. Many newer VHF/UHF amateur rigs include DTMF facilities as standard.

Repeater Linking

As mentioned before, two or more repeaters may be linked together so that users of one repeater can talk to users of another. This is done for the following reasons:-

* To allow longer distances to be covered on the VHF/UHF bands;
* To increase activity on two or more repeaters serving a sparsely populated area;
* To promote activity on lesser used bands (such as linking 10 m and 70 cm repeaters); and
* For experimental purposes.

In places where activity is sparse (eg country areas), repeater sponsors usually want to have the link operational at all times. Where there is more activity or links are used for special purposes only, users may wish to switch links on and off. This can be done by installing special tone decoding circuitry at the repeater. It is then up to the operator to decide whether to activate the link by transmitting the correct CTCSS or DTMF control tone.

Linked repeaters must have better than average receive and transmit quality. This is because each transmitter and receiver in the chain between the transmitting and receiving station degrades the quality of the signal slightly. Generally speaking, the simpler the link, the greater its reliability and the better the recovered audio.

In repeater linking there is considerable scope for ingenuity and experimentation. The following are examples of the types of links that are possible:-

Conventional linking. This method is used when linking two repeaters transmitting on the same band. The method requires an extra transmitter and receiver at each site to be linked. A typical application for conventional linking is when it is desired that

Other Types of Repeaters

All repeaters listed in the *Australian Call Book* use at least two frequencies and operate on FM. However, not all repeaters operate like this. This section introduces the reader to some lesser-known types of repeaters.

"Parrot" Repeaters

A parrot repeater differs from a conventional repeater in that it uses one frequency only. Its name is very apt. Incoming signals are recorded on a digital voice recorder inside the repeater. When the user stops transmitting, the repeater switches to transmit and plays back the recording. This retransmission is heard by all stations monitoring the frequency. In other words, whereas conventional repeaters retransmit the incoming signal on a different frequency *while* the user is talking, parrot repeaters retransmit a recording of the signal immediately *after* the user has finished. Thus, unlike a normal repeater which transmits as it receives, the parrot repeater is either receiving or transmitting and does not do both simultaneously.

This need for repetition makes communicating via parrot repeaters slower than through conventional repeaters. As well, there is a risk of users accidentally transmitting over one another. For this reason, parrot repeaters are most useful during emergency-type communication exercises where transmissions are normally kept short.

Parrot repeaters are very simple to build – no cavity filters or separate antennas are required. Those with some constructional expertise may wish to build their own by adding a digital voice recorder and associated control circuitry to a standard amateur mobile or hand-held transceiver.

Linear Translators

Conventional repeaters transmit and receive FM only and relay only one transmission at a time. Linear translators, in contrast, can relay many signals at once. They work by receiving a segment of frequencies in one amateur band and retransmitting it in another band. Any signal, whatever its mode, appearing within the linear translator's receive passband is retransmitted. This means that a linear translator with a sufficiently wide passband (say 50 kHz or more) can relay several Morse, voice and data transmissions simultaneously. Tuning across the output of a linear translator is a lot like tuning across an amateur HF band, where signals of several different modes can be heard.

Unlike FM repeaters, which demodulate the incoming signal and use the resulting audio to operate the transmitter section, no demodulation takes place within linear translators. Instead, linear translators use a mixing, filtering and conversion process, similar to that which operates in a superheterodyne radio receiver. Again like superhet receivers, linear translators incorporate automatic gain control (AGC) circuits to prevent strong signals from overloading the system.

Most amateur satellites incorporate linear translators. However, their use on land is limited, and none is licensed in Australia. Because they can relay SSB and CW signals alongside FM transmissions, a terrestrial linear translator could have better coverage than a conventional FM repeater at the same site. As well, they make possible activities such as full-duplex voice operation (similar to speaking on a telephone) and transmitting slow-scan television images simultaneously with a voice commentary. For the experimenter, a linear translator would be an advanced project calling for a high level of expertise and access to test equipment.

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RD Contest This Month

A reminder that the Remembrance Day Contest is on later this month. The contest exists to remember the amateurs who died during World War Two. This is Australia's biggest contest, and there is activity on most amateur bands. On VHF and UHF try listening around the FM simplex calling frequencies (146.500, 439.000 MHz). On HF, you will find activity on 80 metres on the Saturday evening and Sunday morning, and (possibly) on 15 and 10 metres during daylight hours. It takes place over the weekend of 16 and 17 August. Rules appeared in last month's *Amateur Radio* on page 37.

a pair of two metre repeaters be linked. Installation of a link transmitter/receiver operating on 70 centimetres at each repeater site allows a station operating through one repeater also to be heard on the other. Figure 2a shows a pair of two metre repeaters that have been linked via UHF.

Off-air linking. This technique is useful when linking repeaters transmitting in different bands (for example, linking a two metre repeater to a seventy centimetre device). It is simpler than conventional repeater linking because only one extra transmitter/receiver installed at one site is required to link two repeaters (Fig 2b). RF spectrum is conserved as no special link frequencies are required.

An off-air link does not have to be between two repeaters. By replacing the two metre repeater at site B in Fig 2b with an ordinary two metre transceiver set to an unused simplex frequency, it is possible to provide access to the 70 cm repeater at site A to stations transmitting on two metres. This could be useful where operators in a particular locality wish to use the UHF repeater at site A, but cannot do so due to local topography. A remote link comprising a UHF transceiver connected to a two metre rig on a nearby hill could provide access without the need for a full repeater. Such installations are particularly attractive for coverage of small geographic areas, or where activity is insufficient to justify the installation of a stand-alone repeater.

Simplex gateways. A simplex gateway is a means to allow access to a simplex frequency by users of a repeater, or vice versa. In its simplest form, it consists of a single frequency FM transceiver wired to a conventional repeater. A typical application is to provide access to ten metres FM to UHF repeater users. This allows UHF operators to enjoy interstate and overseas contacts given favourable conditions on 29 MHz.

Conclusion

This article has given the reader a quick tour of the various types of voice repeaters, with special emphasis given to repeater linking and control. More information about all aspects of repeaters can be obtained from your local repeater committee or group. Also, see the *Repeater Link* column elsewhere in this issue. I would like to thank Will McGhie VK6UU for his assistance in the preparation of this article.

Copies of the 1995 Novice Notes can be obtained through the Internet Novice Notes Online service at *http://www.pcug.org.au/~parkerp/nonline.htm*

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Over to You – Members' Opinions

All letters from members will be considered for publication, but should be less than 300 words. The WIA accepts no responsibility for opinions expressed by correspondents.

Misbelief on New Format for the Call Book

The letter from Max Morris in July's *Over to You* column (page 45) about proposed changes to the method of publication of the *Call Book*, highlights a misunderstanding about the *WIA News* item in the June issue of *Amateur Radio* (page 6), titled "Call Book to be Replaced With New Publication."

It has not been proposed that the *Australian Call Book* be published ONLY in digital form on CD-ROM. To believe this is a mistake. The second paragraph of the *WIA News* item explained the approaches being considered as follows: *"From preliminary proposals discussed, it is anticipated that a replacement for the Call Book would be a more broadly-based publication containing reference material of wide interest among the amateur and short-wave listener community and related enthusiasts. Also being considered are providing the callsign listings in digital form and various options of providing amateur callsign listings in printed form for those who don't have suitable computer or Internet facilities."*

The Council and the Call Book sub-committee are only too well aware that not all amateurs have access to or use computers, because even some Federal Councillors are similarly handicapped!

However, the *WIA News* item did note that there is a local demand for an *Australian Call Book* in digital form and that overseas publishers had recently moved to publish their foreign call books only on CD-ROM.

Neil Penfold
WIA Federal President

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Book Review

The LF Experimenter's Source Book

Publisher: *The Radio Society Of Great Britain*
Author: *Peter Dodd G3LDO*
Reviewed by: *Gil Sones VK3AUI*

In the United Kingdom, amateurs have a new amateur band at 73 kHz which is 2.8 kHz wide. It extends from 71.6 kHz to 74.4 kHz which would permit reduced bandwidth SSB but which is really more suitable for narrow band modes such as CW. It has provoked a lot of interest and is an experimenter's band where the very different techniques and propagation can be explored.

Around the world there are several LF bands available to amateurs and some which can be accessed under special licences. There have been many articles about equipment, aerials and techniques for LF experiments. It is rather different from MF, HF, VHF, and UHF with which we are more familiar.

The RSGB have published a collection of articles from around the world on various aspects of LF operation. Whilst LF was the area where much early communication was carried out in the early 20th century, it is little known to amateurs today. This publication is designed to provide a collection of LF articles.

The book provides general LF information together with more specific information on propagation, receiving and transmitting, aerials and propagation, and specialist techniques and test equipment. It is a very interesting collection of information about a fascinating area for experimentation. Hopefully, in Australia we will one day have an LF allocation and not have to depend on the special experimental licences which have been necessary to date.

The LF Experimenter's Source Book is recommended to anyone with an interest in LF. It provides interesting reading with many practical pieces of equipment and aerials described. LF is an interesting area for experimentation even if you can only listen. There are allocations in both New Zealand and Papua New Guinea as well as a few experimental licensees in Australia.

The review copy came direct from the RSGB. The LF Experimenter's Source Book should be available from the usual outlets for RSGB publications.

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Tell the advertiser you saw it in the WIA *Amateur Radio* magazine!

Pounding Brass

*Stephen P Smith VK2SPS**

I hope you enjoyed last month's issue showing a selection of Australian Semi-Auto Keys as used by ex-PMG operators of the past. As you are aware, some of these keys are still in use today, such as the Simplex-Auto, a key that is getting rather difficult to come by these days.

Obtaining a good quality Morse key today is not as easy as it was some years ago when telegraphy was at its peak. The workmanship was magnificent with each key a labour of love which showed in its appearance and operation whereas today's keys are usually made with a combination of plastic and chrome-plated metals, not at all like the polished brass and smooth operation of a past era.

The number of Australian manufacturers are all but gone these days as keys are mainly imported from Japan and America. Also some from the UK, such as the "Kent" range (normally in kit form) which are quite good quality keys at a moderate price.

Morse keys are like motor cars in that it's always better to test drive before you buy. However, this is not as easy as it sounds as we usually decide to purchase a key either through somebody's recommendation or having read about it through advertising in the pages of an amateur radio catalogue. Then, perhaps, we borrow money from the XYL for the purchase of the key, are disappointed with its performance and never use it again or, in extreme cases, give up telegraphy altogether.

If only we could borrow the key for several days to try it out! If you belong to a club, or borrow from a friend, you will be better off. It may take an operator a number of keys before he finds that perfect key. Again, it comes down to practice and experience.

May I suggest the beginner, with limited funds and little experience, try the following:

1. Ask a friend who may be a keen CW operator (they usually have more than one key and would most likely lend you one);

2. Become a member of a local radio club where you can obtain the information on various keys from the more experienced members who would usually be only to happy to help you;

3. Have a look through the *Call Book* for amateurs within your general area and drop them a line with name and phone number. I'm quite sure they will assist you and perhaps lend you a key (you never know until you try!).

In order to obtain a good quality key in Australia, we are faced with three options:

1. Buying from local companies (in this case it will be an imported key, probably a Hi Mound from Japan, or a Vibroplex, Bencher or MFJ from America, to name a few);

2) Buying second hand from Hamads, etc; or

3) Buying directly from an overseas manufacturer.

Let's take a look at each of the above. For example, two companies who sell keys are Dick Smith and Daycom Communications. Dick Smith offers three keys, the economy Morse Key catalogue number D-7105, the Model HK-707 by Hi-Mound (cat D-7107) and the Model MK-706 (cat D-7108) also produced by the Hi-Mound company of Japan.

The economy key sells for $9.95. This key is basically a copy of an American landline key as used in the second half of the last century. The key consists of a plastic base with chrome plated metal. The base will require to be weighted or attached to a wooden support or screwed to the bench. I hesitate to recommend this key for use either on-air or for practice because of its construction.

The Model HK-707 sells for $79.95. This is a more up-market key, again following the American style, being low in profile yet having a large knob similar to our own PMG keys. This key handles well during operation although I had to add weight to the base to stop chasing it around the table. Another option is to use blue-tack and stick it to the bench.

The last key (or I should say paddle) offered is the Model MK-706 single paddle selling for $109.95. It has a solid metal non-slip base, adjustable spring tension and a clear plastic dust cover (a good idea these days). Unfortunately, I have not used this key. I have spoken with operators who have used it and they have told me it handles quite well.

The company selling the largest range of keys in Australia is Daycom Communications Pty Ltd in Melbourne. Most of the keys are imported from America, with a small range from the UK. The keys offered from America come from such companies as Vibroplex and Bencher. Vibroplex only manufacture semi-automatic keys along with a range of Vibrokeyers and Vibroplex iambic models. These keys are top quality, top performance keys that send beautiful Morse when correctly adjusted and used by an experienced operator who is familiar with these types of keys. Each key comes in three models from "standard" to "presentation".

Bencher products include the Bencher iambic keyer, single lever key and logic key CMOS keyer. Again, sale prices range from standard to the more exotic and expensive models. I will not go into the specific details of each key as this would require a number of pages. However, if anyone has any questions in relation to any of the keys mentioned please drop me a line or, you can contact Daycom for further information on a specific model.

The majority of the market seems to be dedicated to the iambic or double/single combinations. It's a shame not to see more hand keys being offered for general use.

Next month I will continue with second-hand keys and buying direct from an overseas company.

**PO Box 361, Mona Vale NSW 2103*

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VK QSL BUREAUX

The official list of VK QSL Bureaux. All are Inwards and Outwards unless otherwise stated.

VK1		GPO Box 600 CANBERRA ACT 2601
VK2		PO Box 73 TERALBA NSW 2284
VK3	Inwards	Box 757G, GPO MELBOURNE VIC 3001
	Outwards	40G Victory Blvd ASHBURTON VIC 3147
VK4		GPO Box 638 BRISBANE QLD 4001
VK5		PO Box 10092 Gouger St ADELAIDE SA 5001
VK6		GPO Box F319 PERTH WA 6001
VK7		GPO Box 371D HOBART TAS 7001
VK8		C/o H G Andersson VK8HA Box 619 HUMPTY DOO NT 0836
VK9/VK0		C/o Neil Penfold VK6NE 2 Moss Court KINGSLEY WA 6026

Repeater Link

*Will McGhie VK6UU**

Vertical Solar

You may remember the cover of *Amateur Radio* for October 1996, showing a photo of vertically mounted solar panels. An accompanying article in *Repeater Link* described the mounting of these panels.

The reason for mounting the panels vertically was simply to make the job easier. There would be a reduction in overall output from the panels due to them not being at the recommended angle, but how much? The two panels shown in the photo did not face north. One panel faced north east and the other north west. My question was, if a solar panel was mounted vertically facing north, how much would the output be down on a panel with the correct angle facing north?

An opportunity to do some measurements occurred and, using a small panel, I recorded the following results.

The time of year was mid winter. The first three measurements were done at 9.30 am. Firstly, the panel was connected to charge a battery through a meter. The panel was faced towards the sun for highest output. This resulted in a current of 107 mA. Next, the panel was faced north and angled at the recommended angle of 35 degrees. The resulting current was 80 mA. The final measurement was with the panel vertical and facing north, resulting in a current of 75 mA.

The same three measurement were again taken at midday, with the following results: directly at the sun, 118 mA; recommended angle, 114 mA; and vertical, 102 mA.

What the results show is that mounting a solar panel vertically does not reduce the output of the panel by much. If you only compare the 35 degree angled panel with the vertical panel, then there is about a 7% reduction at 9.30 am, and about an 11% reduction at midday. Not a lot, considering the ease of mounting a solar panel vertically. Other benefits could be less dust build up on the vertical panel over the angled panel, and not damaging a panel by dropping an object on to it from above.

The closer to the equator the poorer the output from the vertical panel of course but, for most of Southern Australia, the idea could offer an easy and effective solution to mounting solar panels.

While doing the measurements on the small panel, it was easy to see how little effect the sun angle had on the output of the panel. This may vary with panels that have different types of construction, but it appears there is little need to spend too much time and money getting the panel spot on, angle wise. Pointing north for Australia is the most important, and vertical a useful alternative for ease of construction.

Getting Ready

One of our repeaters in VK6 has been off-air for well over a year. The repeater, VK6RCT at Cataby, about 150 km north of Perth, has only one user living in the area, and mainly services mobile traffic on the Brand Highway. The reasons for the repeater being off-air for so long are many, but the main reason is the lack of any person to do the work to put the system back on air.

However, at long last a replacement repeater was finished and finally put under test in Perth. This replacement repeater was soak tested by replacing one of Perth's repeaters for a couple of months. With all the bugs sorted out, the time had come to take it to Cataby and install it.

This is what this article is about, getting the replacement repeater ready for installation. Sounds easy does it not? The repeater had been under test for two months and the few noticed bugs had been sorted out. However, with the repeater now out of its on-air testing phase, the time had come to finally set up the repeater for installation.

It is easy to say, take a working repeater that has been under test and install it at its new location. However, it is not so easy to do.

The repeater had been on 6750 and had to be re-crystalled for 7200. The receiver had to be peaked on 147.800 MHz from its previous 146.150 MHz and accurately netted to this new frequency. Next, the transmitter had to be accurately netted on to frequency. This repeater uses direct frequency modulation of the transmit crystal, and all crystals produce different amounts of deviation for the same audio input, so the transmit deviation had to be set up.

The repeater was now lined up on the new repeater channel. Next came the change of callsign. This required programming the EPROM in the control board. The changes are written on the computer and, as I don't have an EPROM blower, the EPROM was programmed at work.

This repeater is also interfaced with a UHF link transceiver that also had been under test, and the next set of final tests were to do with the link repeater interface operation. The DTMF remote control via the link worked on the bench, but not via the local Perth UHF repeater that was to be linked to Cataby. The problem was found to be incorrect frequency response to the DTMF controller, the UHF Perth repeater adding just that little bit more error. The DTMF decoder was modified and the remote control now worked.

Next was adjusting the low voltage warning tone contained in the repeater. This had been set up before but needed a final check. Added to the repeater and link system was a low voltage cut-out circuit that disconnects the repeater and link if the battery voltage falls below 10.5 volts. Final tests needed to be done on this unit in conjunction with the low voltage tone warning.

Then came finishing the labelling of the various inputs and outputs of the repeater and link, along with the various controls. Also, covers fitted back into place, as the system was open for modifications and fault finding.

The Cataby repeater site.

Any last minute changes were entered on to the circuits in the computer. All circuits had been drawn using Draft Choice and, even though this design has been used for several repeaters, each repeater has some differences. By the way, this information is worth all the effort. The time it takes is more than offset by the time and frustration it saves.

If all this was not enough, the Cataby site already had a UHF link antenna pointing to Perth. This had been installed many years before, but when last checked had a high SWR. Perhaps the beam was faulty, so a replacement antenna had to be made ready. Rather than swap the antennas if the existing beam proved faulty, the replacement beam was put together with mounting hardware and coax. Not remembering how the on-site beam had been installed meant difficulty in sorting out mounting hardware for the replacement beam. A complete ready-to-be-installed beam, mounting hardware and coax would mean less time required on site. This is important, particularly as the total driving time from Perth is five hours out of the working day.

Loading the Car

These final checks and construction all took place on the Saturday morning prior to travelling to Cataby on the Sunday. Next came loading up the car. This is the bit I hate most. There is so much to remember to take to a remote repeater site, particularly this one, as much of the condition of the site was unknown.

To give you some idea, here is a short list. RF signal generator for testing and aligning the duplexer, VHF and UHF SWR meter, multimeter, soldering iron, inverter to power soldering iron, solder, coax leads, nuts and bolts for UHF beam, low voltage cut out switch, 12 volt power cable, coax adapters, insulation tape, tools, the list goes on and on. And this does not include the important bits like replacement repeater, link transceiver and associated power cables.

On Site

That took care of all day Saturday, just getting ready to go. Sunday it rained all day but the installation went without a hitch. I could even drive right to the top of the hill after having some doubt about the condition of the gravel track.

Also, this was the first time to try out the de-sense adapter, as described in June *Amateur Radio*, page 44, in a real field situation. I did some initial SWR measurements on the duplexer that had been left at the site, and it showed the duplexer was misaligned badly. Using the adapter, signal generator and SWR meter I was able to do a perfect line-up of the entire duplexer. The result was minimum loss through the duplexer, good SWR and zero desensing. The de-sense adapter really worked in a practical situation. It made the line-up easy and fast.

The purpose for putting this on to paper is to give you some idea of the amount of effort to put a repeater back on air. It may sound easy, but it does require lots of effort, preparation and time, along with travelling expense. Those of you who maintain repeater sites will have many stories to tell. How about a couple, so the amateurs who use these systems can better understand the effort, and why some systems remain off-air for so long?

At Last

The licence for our 29 MHz gateway has, at long last, been issued. From first writing to our local WIA to start the effort to allow 29 MHz gateways, until the licence was issued, took almost three years!

We have a hobby which changes due to technology and requires ongoing regulation updates, but we must do better than three years. We could be in a situation where a completely new technology could be redundant and replaced by the next round of technology before the relevant regulations are changed to allow use of the first technology change. What we need is less regulation. Did someone mention de-regulation of the amateur service a while back?

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Club Corner

SADARC Hamfest

The Shepparton and District Amateur Radio Club will hold a Hamfest on 14 September 1997, commencing at 10.00 am, at a new, expanded venue, the Mechanics Institute in Wyndham Street, Shepparton.

Ideally located in the central business district, with off-street parking available in Welsford Street, the Mechanics Institute is between Nixon and Fryers Streets. All amenities are nearby. Check out the Club net on Wednesday evenings at 8.00 pm on 146.650 for further details. Hope to see you there!

MaryAnn Williamson
Secretary.

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Spotlight on SWLing

*Robin L Harwood VK7RH**

There is quite a lot of news this month, following the closure of Monitor Radio International. As I have previously reported, the owners, the Christian Science Publishing Society, decided to close down the weekday "Monitor Radio International" and put the short-wave senders for sale. It initially appeared that another Boston newspaper was going to acquire the Monitor Radio International, which included a syndicated news service on one of America's public radio networks, yet this fell through because many of these stations were not interested in taking it. Many preferred, instead, to run the BBC World Service, which gave the "Beeb" a big boost to their placements in North American domestic markets. The final MRI programs came out on 27 June but I believe that weekend religious programming will be continuing over short-wave, as has been the case since the Christian Science Church launched the service.

Radio Australia also made significant alterations to their schedule on 30 June, after their budget was slashed. Several prominent language sections were also axed, including Cantonese, Thai and French. All remaining language services were reduced in output, including English.

The Cantonese Service actually closed on 29 June. This was only 24 hours prior to the hand-over of Hong Kong to the Peoples' Republic of China by the UK Government. As you may be aware, Cantonese is the lingua franca of Hong Kong and most of southern China, with many overseas Chinese also fluent in this dialect. Radio Australia's Cantonese service was listened to across Asia and with the continuing uncertainty regarding Hong Kong's status as a special administrative region within the PRC, many were relying on Radio Australia's voice to report on what is happening.

Another major decision was to mothball the transmitters on Cox's Peninsula just east of Darwin and solely rely on Shepparton (VIC) and Brandon (QLD). This decision will likely mean that signals will not get into Asia as easily as they do from Darwin. The future focus of Radio Australia seems to be the Pacific, as the Niugini service is unaffected by the cuts. Because the Darwin site is not being utilised, other international broadcasters, including Radio Free Asia, the BBC World Service, Radio Netherlands, Deutsche Welle, plus some religious organisations, have expressed interest in using the senders. Fortunately, they have not been dismantled but can be brought online at a moment's notice.

Recently I was tuning across the 25 metre broadcasting allocation, when I came across a religious program "Through the Bible" which is carried over many evangelical stations including HCJB and Trans World Radio. I naturally assumed it was one of those but, when I heard the address at the end of the program, I thought I had come across TWR Swaziland. However, my Klingenfuss CD-ROM said that Swaziland was not on that channel and the TWR programming was coming from Meyerton, South Africa. I quickly consulted the SENTECH web site and confirmed that it indeed emanated from there. Apparently SENTECH is very similar to our National Transmission Authority yet is commercial, hiring airtime over their senders. Clients include Channel Africa, the BBC World Service, Radio France International, Radio Netherlands and Deutsche Welle.

Trans World Radio has also hired airtime to reach African audiences. The Meyerton site is also engaged in clandestine broadcasting, yet this does not appear on their web site information. Several Nigerian political dissident organisations are known to be broadcasting via Meyerton back to Nigeria.

I am surprised that the signals from Meyerton are so clear and reliable, as African signals are usually very patchy here in Tasmania. However, the 11730 kHz signal is quite good between 0600 and 0645 (when it closes). The signal level does slowly drop off to be almost unreadable by then. The information on the site says that it is beamed to West Africa using a 500 kW sender, Presumably we are getting the signal off the back of the beam. I have already forwarded an e-mail report to SENTECH and have had this confirmed by return with a proper QSL apparently on the way via snail mail. Their e-mail address is *ottok@sentech.com.za* .

I have recently tried out a Radio Shack amplified short-wave antenna, which is currently available from Tandy stores nation wide. The unit is very small and compact and requires a 9 volt battery or an AC adapter. It comes with a 3.5 mm connecting cord between the radio and the unit. I tried it out with a cheap multi-band radio I have had for a while and the unit does work but easily overloads. The unit has two ranges, one from 3 to 10 MHz and the second from 10 to 30 MHz. In reality the range is from 4 to 9 MHz and the upper range does not work satisfactorily as tuning is very critical with hand capacitance making it difficult. The unit sells for $49.95 and I am a little disappointed; but it would probably be worthwhile on the lower bands as it does peak up signals on the whip on the unit. I haven't tried it with an external antenna.

There was another bit of radio history on 30 June/1 July, when the Crown Colony of Hong Kong was returned to China. This event was covered extensively by the world's media and many stations, including most HF outlets of the Chinese domestic services, broadcast the hand-over ceremonies live. The BBC World Service also covered it. It was strange hearing the speech by the Prince of Wales in English live and without translation via the Chinese outlets, particularly on 6115 and 7504 kHz. I also found the various satellite feeds were at different times, with the short-wave feeds being a good second ahead of the television audio. Incidentally the callsign block VRA to VRZ on the ITU lists should now be modified to the PRC as the UK Government relinquished it on 1 July.

I am also informed that VIS Sydney Radio is closing, with the Doonside/Bringelly sites and the remaining senders being remotely controlled from either Brisbane or Melbourne. VIT Townsville is also being remotely controlled from Brisbane on voice, whilst the ICW is being controlled from Melbourne. VID Darwin is also being remotely controlled from Perth Radio. Vale VIS!

Well, that is all for this month. Until next time, the very best of monitoring and 73.

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Repeaters – additions, deletions, alterations. Have you advised the WIA of changes needed to the Repeater List?

VHF/UHF – An Expanding World

*Eric Jamieson VK5LP**

All times are UTC.

Six Metres 50 Years Ago

As I advised a couple of months ago, in this August issue I planned to remember the 50th anniversary of the World Record contact between Clarrie VK5KL and Eugene W7ACS/KH6 which took place at 1240 CST (0310 UTC) on 26 August 1947 on the six metre band, 50 to 56 MCs (at that time, frequencies were referred to as Megacycles or MCs, or megs for a short title). Clarrie made the contact while he was living in Darwin. VK5 callsigns then were used for South Australia and the Northern Territory. The distance was considered to be 5350 miles or 8610 km. I presume Clarrie will open a bottle of champagne to celebrate the memory of that contact 50 years ago!

I wrote to Clarrie VK5KL, who lives in the Adelaide suburb of Enfield, where he is still active on six metres, these days with 10 watts but this was sufficient to give him contacts to OZ1LO, SM7FJE, IN4KST and OK3RV on 8 February 1992.

Clarrie sent me the following information: *"Pleased to receive your letter. It is great to know that a few still remember that contact as it is a long time since the event occurred.*

"I passed the AOCP exam in October 1933 but had to wait until my 18th birthday in December before I could apply for a licence. I came on air in early 1934. I operated on the old 56 MCs band (five metres) and in late 1934 had my first QSO with VK5IT. A joint portable operation with Bill Lloyd VK5HD and Pete Bowman VK5FM at The Hummocks north of Adelaide produced a VK5 record five metre contact with Max Farmer VK5GF, who operated from Mount Lofty.

"Soon after, I joined Bill VK5HD and took part in timing the Australian Speed Boat Championships held at Murray Bridge. We used portable transceivers!

"My pride and joy was building a long-line oscillator using copper tubing in both the grid and plate circuits, and this was displayed during a lecture by Professor Kerr Grant at the University of Adelaide.

"During World War II I served in the RAAF as a Wireless Operator Mechanic in Darwin from early 1942 until late 1945. On demobilisation I transferred from the PMG Dept to DCA (Dept of Civil Aviation) and took over the operation of Civil Aeradio early in 1946.

"After World War II, amateur radio licences were issued for the band 50 to 54 MHz, replacing the pre-war 56 to 60 MCs allocation. Following the good results already being attained in the USA, we made efforts to build equipment for the new band. I planned to make a converter to feed into my AR7 receiver, but small variable condensers (now capacitors) were not available. This was overcome by asking one of the Qantas pilots flying to London to buy some Eddystone capacitors for me. The resulting converter used a 956 RF stage, detector and 955 oscillator. It was a rather rough affair as parts were scarce.

"During 1946, whilst working W7ACS/KH6 on 28 MHz, we had discussed operation on 50 MHz. Eugene mentioned that a scientist from the Ionospheric Weather Station had suggested we change from vertical to horizontal polarized antennas as this might improve the chances of reflection from the ionised Heavyside Layer.

"Both of us constructed three element horizontal Yagis. Mine was made from electrical conduit. There being no one else on six metres in Darwin, on a visit to Melbourne I took the converter to Max Howden VK3BQ to check that it would receive 50 MHz. It did!

"At a disposals sale I had bought a T1131 transmitter. It was made for the Air Ministry as a ground-control transmitter and brought to Australia for use with the Spitfire Squadrons. It ran 100 watts of CW or AM from a pair of 834s, and covered 100 to 125 MHz. I changed the coils to tune 50 MHz.

"Each month, using the Ionospheric Prediction charts issued from Mount Stromlo, careful watch was kept when the MUF charts showed around 50 MHz. This paid off on 26 August 1947 when, soon after 12 noon (0230 UTC), a weak signal was heard just inside the 50 MHz band. The signal increased in strength until I identified W7ACS/KH6 calling CQ six metres. The QSO finally occurred at 1240 pm (0310 UTC)."

This world record QSO on six metres was reported in *QST* under *The World Above 50 Mc* for October 1947, conducted by the late Ed Tilton W1HDQ. He wrote: *"That 27th again! For the fourth consecutive month, the lead paragraphs of this department are being rewritten to report extraordinary happenings on the 27th of the month. This is an important date to remember,* [and still is ... VK5LP], *because it gives a good indication of the period to watch each month for DX opportunities through the fall season. Between 25 and 27 August there were at least three events that are front-page news to VHF enthusiasts: the first two-way work between Australia and the Hawaiian Islands on 50 Mc, the first Mexico-Argentina 50 Mc QSO, and a new DX record for home-station worked on 144 Mc.*

"The 50 Mc record passed 5000 miles at 1700 Hawaiian Time, on 25 August, when W7ACS/KH6 at Pearl Harbor worked VK5KL, Darwin, Australia, a distance of 5350 miles (5349.8 according to W7ACS!). This contact renewed interest in the possibilities for 50 Mc communication over this path, and though no new VK or ZL contacts have been reported at this writing, the prospects remain good through the fall."

The *QST* article included a copy of VK5KL's QSL to W7ACS/KH6 and a picture of his three element coaxial fed beam, 0.2 wavelength spacing.

Emil W3EP, in response to a request from me for information about the contact, replied that during the 1946-47 winter, W7ACS/KH6 was active on 50 MHz, with much written about him and the main story being his contact with J9AAK. Here is a bit from May 1947 *QST* (page 62 in the *World Above 50 Mc* column: *"W7ACS/KH6 has been trying to duplicate his feat with J9AAK and VKs, but without much success, except for some very brief exchanges between W7ACS/KH6 and VK4HR of Brisbane, Australia."* [the text which followed revealed the pair heard one or the other, but not a two way, on Feb 27, Feb 28, and Mar 2.]

In the light of the above, Clarrie was fortunate to have been the first to make a two-way contact with Hawaii.

Amateur Radio for October 1947 contained an article under the heading *50 MC'S WORLD RECORD* and is based on a letter from Clarrie VK5KL advising of his contact with W7ACS/KH6. Excerpts read as follows: *"DX on 50 Mc is not a dream any longer. In all my 14 years of amateur radio nothing has thrilled me so much, not even that first ever QSO or working an elusive South American. Ever since 1934 when I first QSOed VK5IT on the old 56 Mc band using a battery operated super-regen receiver and an ultra-audion circuit transmitter, I have dreamed, planned and strived for better equipment and more co-operation to popularise the band.*

"The war years intervened, then 1946 and back on the air. Allotted 50 to 54 Mc and a real chance now as 50 Mc comes well within reach of MUF prediction, when high enough. Improved techniques, superhet receivers, crystal controlled transmitters and multi-element beams all in the right trend to bring that dream true.

"December 1946. The band looked like opening. Interstate DX was achieved, honours to VK2NO and VK3MJ. Encouraged by activity in Honolulu, Japan, Okinawa, Singapore and India, the chance of real DX might yet be achieved. Close study of MUF Prediction Charts and ionospheric prediction issued by Mount Stromlo followed.

"On 22 August a severe disturbance took place and the usual watch was kept when at home, usually around noon. Skeds were being kept with VK5NR and VK3BQ. Arriving home at 1200 hours on 26 August, the beam was swung in the direction of VK3, a weak signal was heard and fading rapidly - it was W7ACS/KH6 at Pearl Harbour calling 'CQ six metres.'

"Rushing outside to manipulate the ropes on the beam I became entangled amongst them in my haste. Return inside and frantic calling. Almost unable to hold microphone and speak at the same time. No reply.

"At 1215 W7ACS/KH6 called CQ, R3 S5. I called on 51.5 and 50.025 with no result. At 1230 he called again, I peaked the beam and called again. Perspiration stood out on my forehead as he answered QRZ? Again I called long and loud, at fever pitch now for the reply. Time was 1240 and the greatest moment of my life passed as W7ACS/KH6 answers calling VK5KL Darwin and saying: "Well! Well! This is one for the books", and offering congratulations.

"His signal came up to S7 and he gave me S3. We continued for several overs describing each other's gear. We arrange a sked for 1200 each day. His signal reached S8, as can be vouched for by my neighbour VK5SA, who came to witness the

closing overs. The contact lasted ten minutes and closed with both looking for other stations.

"I relaxed with radiant joy as I realised that I might have the coveted honour of being the first VK to work outside Australia on 50 Mc."

[It must be remembered that both stations were crystal-locked, there was no such thing as answering on the other party's frequency as we do today. The contact was completed because W7ACS/KH6 continued to call CQ and tuning, though apparently not hearing any replies in the early stages, he obviously thought it worthwhile to continue. ... VK5LP.]

Part 2 of *Six Metres 50 Years Ago* next month.

Geelong Beacon

Last month I outlined the changes which had been made to the Geelong beacon VK3RGL on 144.530, by Charlie VK3BRZ.

On numerous occasions, morning, day and night time, I have listened for the beacon and on every occasion it has been audible. Signal levels vary from just audible to S5, depending upon propagation conditions. When it is weak I need to use the masthead pre-amp, but on many occasions it is audible without its use. The distance to Meningie is about 550 km.

Upon advising Charlie, the following e-mail was received: *"Thank you for your feedback concerning the Mt Anakie beacon. It's very gratifying to see that it's producing the results I was hoping for. I'm especially looking forward to reports from VK6 later this year. Is there anyone at Port Augusta who might look for it?*

"The VK2s are certainly benefiting from the increased signal level towards them. I have been informed that even Gordon VK2ZAB hears the beacon regularly via aircraft enhancement, which is pretty good going. Mark VK2EMA at Tottenham (almost 700 km) hears it continuously (throughout the day, even), as does Rod VK2TWR at Nimitabel."

Two Metres Propagation

Charlie VK3BRZ added the following to his e-mail: *"Mark VK2EMA phoned me Sunday 9/6 to say he was hearing our beacon at S3-5. I couldn't get to my rigs there and then, so we made a sched for that evening at 12:00.*

"At the appointed time, Mark called me first on 80 metres (we use 3.690 MHz to avoid QRM from the ATV chaps a little higher up the band). We went to 144 and worked with 5x9 signals both ways. At one point Mark dropped his power to five watts and was still comfortable copy (we normally both run 400 W for these contacts).

"From 144 we went to 70 cm and made a comfortable 5x3 contact both ways. Things were looking pretty good, so I tried to raise some activity from Melbourne. John VK3KWA responded and worked Mark easily on 144, then went to 70 cm. He has a single Yagi and defunct pre-amp on 70 cm, but still managed a contact.

"The pair then went to 1296 MHz, where they struggled for an hour on CW, finally completing an unconvincing contact at 1330. We all went back to 144 and 70 cm, finding signals on 70 cm had increased to S9+20! We enjoyed a three-way QSO on that band for a while and, before closing, Mark and John (sounds biblical, doesn't it?) returned to 1296, this time easily working on SSB with very good signals, so much so that John was able to relay proceedings to me via 2 m.

"Now for the clincher. I suggested to Mark that he ought to check the Mt Lofty beacon VK5VF, and he reported that he was hearing it quite well. No VK5s though, who by now were probably sensibly tucked up in bed. But had they been around earlier, they would have had a ball.

"For the record, the distances are: VK2EMA to VK3BRZ 700 km, VK2EMA to VK3KWA 650 km. Not bad for winter, eh? Of course, everyone knows VHF DX is only a summertime phenomenon!"

New Records

John VK3KWA advises of two new records which can be added to the list published in May *Amateur Radio*. They are:

1296 MHz: VK2 record: VK2ZAB - ZL1AVZ 21/01/97 2145.7 km.

2400 MHz: Mobile record: VK3TMJ - VK3XXX 11/01/97 180.5 km.

The 2400 MHz mobile contact was from Mt Kosciusko to Mt Buller. Mode FM, both stations one watt to vertical antennas.

John also advises that anyone who is interested in operating on this band, should note that the CW/SSB calling frequency has moved to 2403.1 MHz, but should not be used for FM. The national FM simplex calling frequency is 2425.000 MHz.

VK to UK/EU Data List

Thank you to those people who responded to my request in the April issue for details of contacts between VK and the UK and Europe.

The final tally of contacts came to 2943. I know that this is not all the contacts made, but was the most I could assemble with the provided information.

The list has been sorted into six files in strict order of progression: date and time, time, VK callsigns, VK grids, UK/EU callsigns, UK/EU grids. There is also a statistics file which is a breakdown of the information for comparison purposes and is a very valuable file.

All the information comes to 928 kB, far too large to send by e-mail at STD rates with my phone line limit of 9600 bps. Therefore, all the information is contained in seven files on a virus free 3.5 inch IBM brand-name 1.44 mB computer disk. The six main files are in six columns in ASCII text which allows conversion to your own format. It readily converts to an Excel spreadsheet.

The disk is being made available at cost only, including return postage, for seven 45c stamps from VK amateurs. Overseas amateurs send $US4.00 for airmail return postage with disk sent in a PostPak Computer Disk Mailer for safe delivery. Orders by letter only, accompanied by funds.

Overseas

Chris Gare G3WOS reports that the first transatlantic six metre QSO this year took place on 08/06/97 at 1217 between Doug VE1PZ and Frank PA3BFM. VE1PZ was once again alerted by the EU video carriers on 48.250/.242 and 49.730/.750/.760.

Ted Collins G4UPS reports in his May notes the dates and times of the first openings "across the pond" from his station in IO80 as follows:

06/06/88 1513 WD4KPD
24/06/89 1422 W1AMG
21/06/90 1243 VE3KKL
24/08/91 1233 K1JRW/VE1/VE3
13/05/92 2013 VE1RG
05/06/93 2139 VE1YX
19/06/94 1948 VE1RAA/FP
19/06/95 2046 W1/2/3/4/VE1
28/05/96 1806 VE1/W1/W8/FP
1997: No openings in May

Usually, the openings are preceded by hearing 10 metre beacons or contacts. It is interesting to note that Canadian stations often feature in the first openings. The other point of interest is that, as Cycle 22 moved towards its peak, the openings commenced earlier in time.

However, despite no openings "across the pond" in May, Ted managed contacts with the following countries: 4X1, 9A, CT, CU3, D, EH, EH6, EH8, EH9, ES, EU, F, G, GM, GW, HB9, I, IS0, JY, LA, LY, LZ, OD, OE, OH, OK, OM, OZ, PE, S5, SM, SP, SV, YO, YU, Z32, ZB2. That's 37 countries and he heard SU1ER from Egypt but was unable to contact him due to QRM from other stations in a pile-up. Overall, quite a good effort for the first month of summer Es contacts. Also, 19 beacons were heard.

Internet Six News

The following snippets of news come from **Geoff GJ4ICD** who reports that, on 3/6 at 0700, six metres was wide open with 4X, SU and JY4MB into Europe. He logged 45 countries for the day in GJ! Lots of new rare grid squares were active, such as UR4LL in KO70, EW8DD/KO42, ES3RM/KO28, SV7BVZ/KN21, SM4HEJ/JP43. [They certainly get it easy in Europe ... VK5LP.]

On 5/6 Tim V73AT, on Kwajalein in the Marshall Islands, had a JA opening between 0730 and 0900, working JA2, JA3 and JA9 stations and hearing VS97XVD. [Tim should be a possible contact from VK at least during September or October.]

8/6: **Mike ZL3TIC** at 0440 worked VK3DUT 50.130 5/9+, also VK2s on band, and 46.240 5x9 for two hours.

11/6: Doug VE1PZ had a superb opening at 1200 to 1315 into G, GW, PA, ON, GJ, at 599 and 5x9 SSB, making 37 contacts!

18/6: Further big six metre openings in Europe, including 144 MHz Es contacts. 5B4 beacon heard for more than 12 hours, but still no major opening between Europe and USA.

20/6: **VS6 news:** From 28/6 to 2/7, Hong Kong will be on holiday to celebrate the change over to Chinese rule. A special event station VS97SAR and VR97SAR will be operational, including six metres. There is a rumour that Hong Kong will become a deleted country from DXCC.

22/6: Further widespread Es openings across Europe. At 1830-1840 VE1PZ to GJ4ICD at 599.

From the USA

Emil W3EP in *The World Above 50 MHz* advises that during June Sporadic E in the US had been generally poor. Openings have been short and not spectacular, with very few double hop coast-to-coast contacts. No one in the US has worked Europe. Caribbean contacts were very scare, even for W4s.

"This was in stark contrast to the spring and summer sporadic-E season which got off to a

roaring start. Six metre operators reported openings across the US on 27 of the 31 days of May. Most of these were the usual single-hop affairs. Stations along the East Coast, from Nova Scotia to Florida, also heard 48.242 and 48.250 MHz European television video signals from Spain and Portugal on 10 days. This is also an auspicious start, but there were few other signs of transatlantic propagation.

"There was 6 metre E-skip propagation somewhere in the US on every day of the month except May 1, 16, 17, and 30. Nearly all of these openings were brief and involved only single-hop contacts out to 2200 km or so. Opportunities for real DX were scarce and there were seemingly fewer openings to the Caribbean than in previous May's. Perhaps May 25 was the best single day for 6 metre sporadic E, with double-hop across North America and some encouraging transatlantic signs."

Progress on 50.200 MHz

Emil continues: *"Several reports included comments on the improved operating habits heard on six metres in recent months. During nearly every opening in May, stations were calling CQ on 50.2 MHz and getting quick replies but, more significantly, they could be found all up and down the band. I found it relatively easy to make more than 35 QSOs in an hour or so by calling CQ on 50.205 MHz during the Six Meter Sprint - and the band was not open! Crowding around 50.125 MHz has diminished considerably and there is already good activity at 50.200 MHz and higher. Six metre operators seemed to be enjoying themselves much more, primarily because QRM, splatter, and jostling around the low end of the band has been reduced considerably. Please continue to explain gently to those who have not received the word that domestic activity starts around 50.200 MHz and spreads out from there."*

[I hope that during our next Es season in VK that I can say the same thing about VK operating habits, and also those of the JAs who seem habitually to inhabit 50.110, in some cases repeated QSOs by the same station being noted.]

W3EP also reported news from JA1VOK that the Es season in Japan started well during May. Many Japanese six metre operators have worked HL, BV, VS6 and DU stations. Other more exotic catches for the Japanese included XU2A (Cambodia), BS7H (Scarborough Reef), 9M2TO (West Malaysia), JD1BIY (Minami-Torishima), V73AT (Kwajalein), and KH2D (Guam). Those are scarce DX countries on any band!

Closure

Closing with two thoughts for the month:

1. Courage in people is like a tea bag. You never know the strength until they're in hot water, and
2. Anybody who doesn't cut his speed at the sight of a police car is probably parked.

73 from The Voice by the Lake.

**PO Box 169, Meningie SA 5264*
Fax: (085) 751 043
Packet: VK5LP@VK5WI.#ADL.#SA.AUS.OC
E-mail: vk5lp@ozemail.com.au

ar

Silent Keys

Due to space demands obituaries should be no longer than 200 words.

The WIA regrets to announce the recent passing of:

M H (Maxwell)	MURPHY	VK3ACF
F W (Frederick)	MILLS	VK6MN

Stanley Ivan Zeunert VK3SZ

Stan Zeunert VK3SZ passed away on Tuesday, 3 June. A number of amateur friends took part in a well attended funeral service on the following Friday.

Stan grew up near Hamilton where he obtained his licence and callsign in 1938 at the age of 17. World War II cut short his use of the call.

In 1941 Stan went to Melbourne to enlist in RAAF Signals. He was told there were no vacancies in signals, but he would be welcome to join a new top secret unit. And so he became an early trainee in radar. On completion of his training his unit was sent to Darwin to set up a radar station which they did shortly after the first Japanese bombing raid. Later he was transferred to Metung on Victoria's south coast and later to Victoria Barracks in Melbourne to write instruction manuals. He was discharged late in 1944 – the year he was married – with the rank of Warrant Officer. In civil life he specialised in the design and manufacture of car radios. First with Healings for a total of 35 years, then Astor radio and, finally, Philips. He retired from Philips in 1986 at the age of 65. On company business, he visited England and Holland followed by many visits to Japan.

As an amateur Stan used phone rather than CW and, in later years, kept a regular afternoon sked on 80 metres. The antenna he used is another story.

Stan was a member of the WIA, the Moorabbin and District Radio Club and the Radio Amateurs Old Timers Club. He was a dedicated home brewer and a meticulous perfectionist.

He is survived by his wife Wilma, his children David, Meredith and Roslyn, their partners, and eight grandchildren.

A lot of people will miss Stan, that's for sure.

Allan Doble VK3AMD

Keith Schleicher VK4KS

Past President WIAQ 1947

After suffering indifferent health for some time, OOTer Keith VK4KS became an SK on 24 May 1997. He was 78 and had been licensed since 1937.

In his own quiet way VK4KS proved to be a man of outstanding ability and achievement. Forced to leave school at primary or scholarship level because of the great 1930-1932 depression, his first job, in what was to become a lifetime career in electronics was as a chassis wirer in a Brisbane broadcast factory.

From this point on, purely by self motivation, home study and diligence, Keith went on to become highly skilled in the state of the art.

In SE Queensland he pioneered two-way radio in taxi cabs. This facility considerably speeded up the cab-at-the-front-door service as never before.

The magnitude of this accomplishment by VK4KS seems all the greater when it is known that Keith designed, hand built, installed and maintained, including the Mt Cootha repeater, all the equipment by his own effort (no helpers).

This smooth and efficient service gradually extended its umbrella to cover Toowoomba and Tweed Heads in NSW.

At the time of Keith's retirement in the late 1960s, the number of taxi cabs equipped with his two-way radio system was approaching 200, all homebrewed and, of course, professional in appearance.

In amateur radio he became one of VK's greatest Dxers, remaining at the top of the DXCC ladder for many years.

Keith VK4KS is survived by his YL Gwen and daughters Joyce and Dawn. He will be sadly missed by his peers in this part of the Sunshine State.

Inserted by two of his lifelong mates,

Fred Lubach VK4RF and
Alan Shawsmith VK4SS

ar

Help stamp out stolen equipment – always include the serial number of your equipment in your HAMAD.

Ionospheric Update

*Evan Jarman VK3ANI**

Solar Activity

Solar activity was very low to low during the quarter. Two flares (class M1.9 at 1348 UTC, 1 April and class M1.3 at 2015 UTC, 21 May) saw activity rise to moderate level. There were also several geo-effective coronal mass ejection (CME) events.

Ionospheric Activity

In April there was an ionospheric depression observed on 22 April due to geomagnetic activity on the previous day. A depression was also observed around Darwin from 26 to 30 April, cause unknown.

Around 15-16 May a disturbance made the ionosphere highly variable.

Geomagnetic Activity

There were several disturbances during the quarter. They were related to CME events. The strongest were on 11 April and 15 May. A smaller disturbance at the beginning of May was also CME related. Activity in June was quiet, increasing to unsettled late in the month.

T index

The Ionospheric Prediction Service revised the T index values in June. Again, it was just fine tuning, particularly during 1997 as shown on the graph.

Solar Cycle 23

As stated in the last quarterly update (*Amateur Radio* May 1997, page 50) conditions are now under the influence of a new solar cycle, number 23. It is now accepted that this cycle's influence started affecting activity in early 1996. It has taken a little time to confirm this, mainly due to some unexpected activity.

The sunspot number first rose, then declined, confusing observers. After the sunspot number resumed rising, the minimum has been fixed at May 1996. The new solar cycle is not rising as quickly as its predecessors. It is the fifth slowest of the observed cycles based on observations to date. This does not reflect on the eventual cycle peak as these are still early days.

Vale Solar Cycle 22

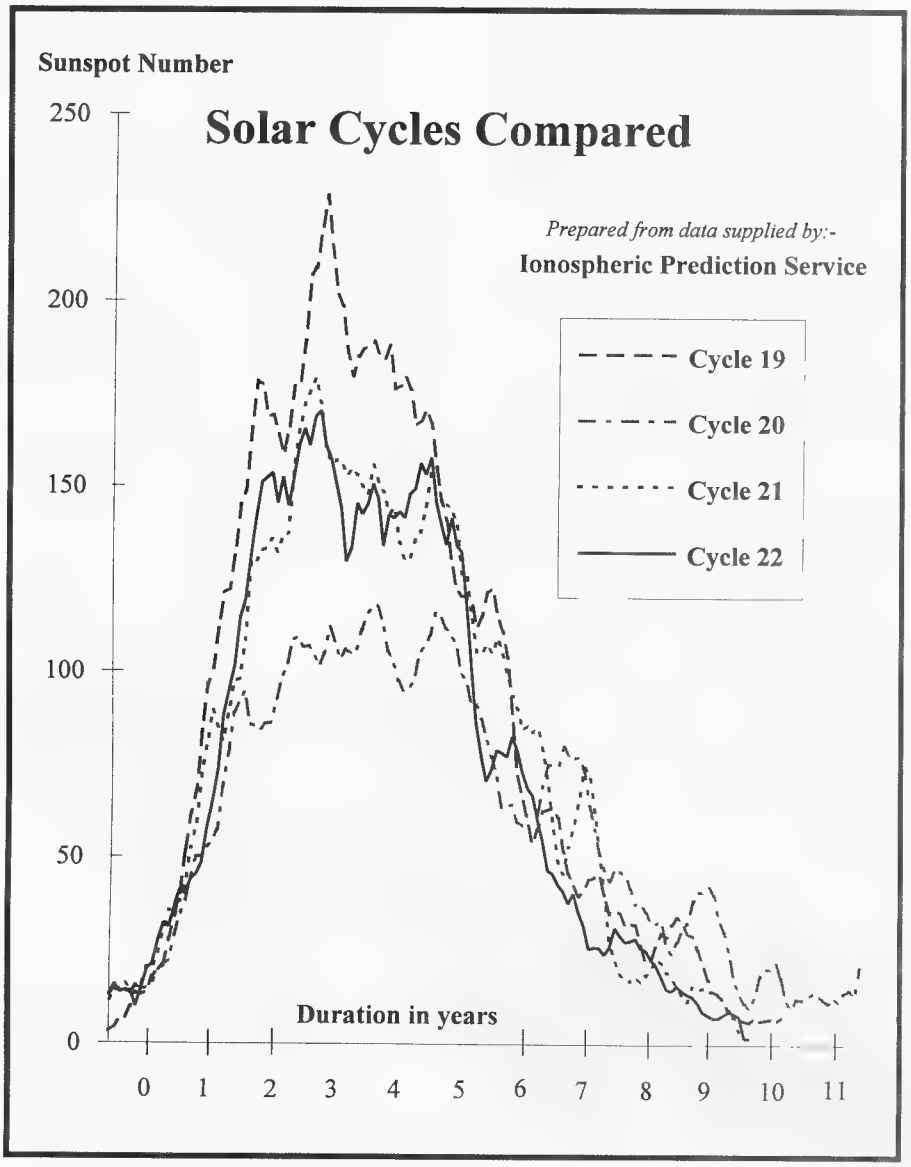
The passing of a solar cycle, one of old Sol's better efforts, cannot be left un-noted.

Solar cycle 22 had the shortest rise time, from minimum to maximum, of any cycle in recorded history. People were predicting that it would be larger than cycle 19, the highest on record. The rise in cycle 22, however, abated in early 1989 and then it peaked in July. There was then a gradual decline to the minimum in activity in May last year. The cycle was very active which should be reflected in log books. It also produced some remarkable activity for observers.

To quote from an Ionospheric Prediction Service Summary:-

"Prime was the March 1989 period which started on 6 March with the appearance of a large sunspot region on the eastern edge of the sun. The next 14 days produced 11 "X-class" flares (the largest category in X-ray emission) and 48 "M-class" (still very large flares). However, the most outstanding feature occurred on 13-14 March with one of the largest geomagnetic storms in the last 50 years.

"The storm had an amazing list of effects on earth and in space. Power systems in Canada and Sweden failed as large electric currents were induced in power lines and tripped protective relays. Increased atmospheric drag resulting from the



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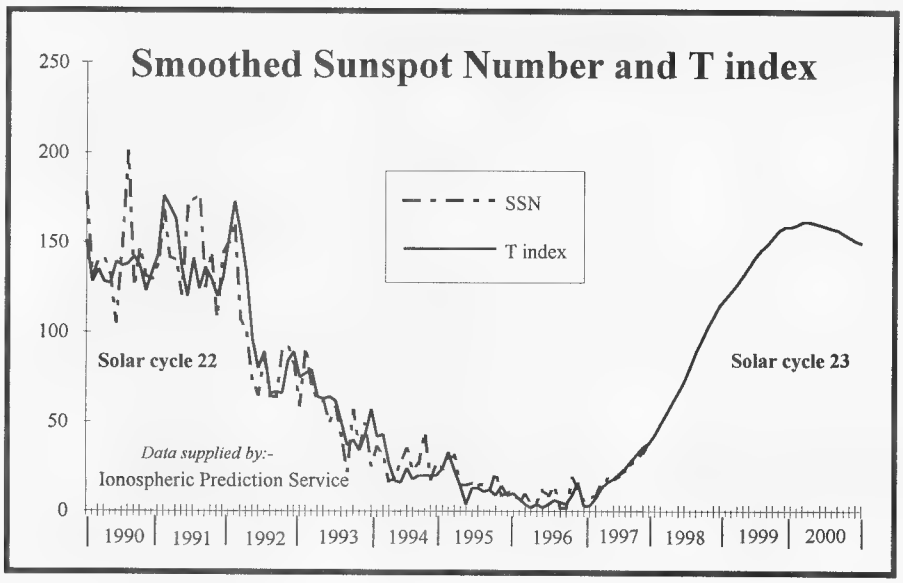


expansion of the earth's outer atmosphere during the disturbance, altered the orbits of many satellites with the result that NASA lost track of several of them for a short period. Satellite navigation systems failed to operate and High Frequency (HF) communications systems were also out of action.

"Aurorae were sighted at quite high equatorial latitudes. The southern regions of Australia were under cloud but numerous sightings were made into Queensland and even Exmouth in Western Australia (which is north of the tropic of Capricorn)...

"June 1991 was the most outstanding solar flare activity of this cycle, and probably the largest since the peak of record Cycle 19. The interval from 1 to 17 June was filled with numerous intense solar flares. An interesting indicator of the strength of this activity came from the US GOES satellites which measure the X-ray output of flares. X-ray detectors on GOES saturated during five flares over the period. Other Flares have occasionally saturated the detectors but it was a unique event for more than one flare from a single region to achieve this feat.

"If saturation of the GOES detectors is a measure of strength, as in old time carnivals, then solar activity in June 1991 "rang the bell" like never before!

"In Australia, we were well placed to see the fireworks because, by sheer chance, many of the large flares occurred during the middle of our day. This meant that many local HF communications were badly disrupted by short-wave fadeouts which cut circuits for many hours. An interesting side effect was the occurrence of several magnetic crochets during the month. These abrupt changes in the terrestrial magnetic field arise because of rapid ionisation of the D-layer of the ionosphere during a large solar flare (this is the same effect which causes short-wave fadeouts when HF signals are absorbed in the highly ionised D-layer).

"Magnetic crochets are rarely observed because a flare must be both energetic in X-rays and also occur close to local midday. In Sydney, at the IPS Space Forecast Centre, we saw three in one week. June 1991 was quite remarkable!

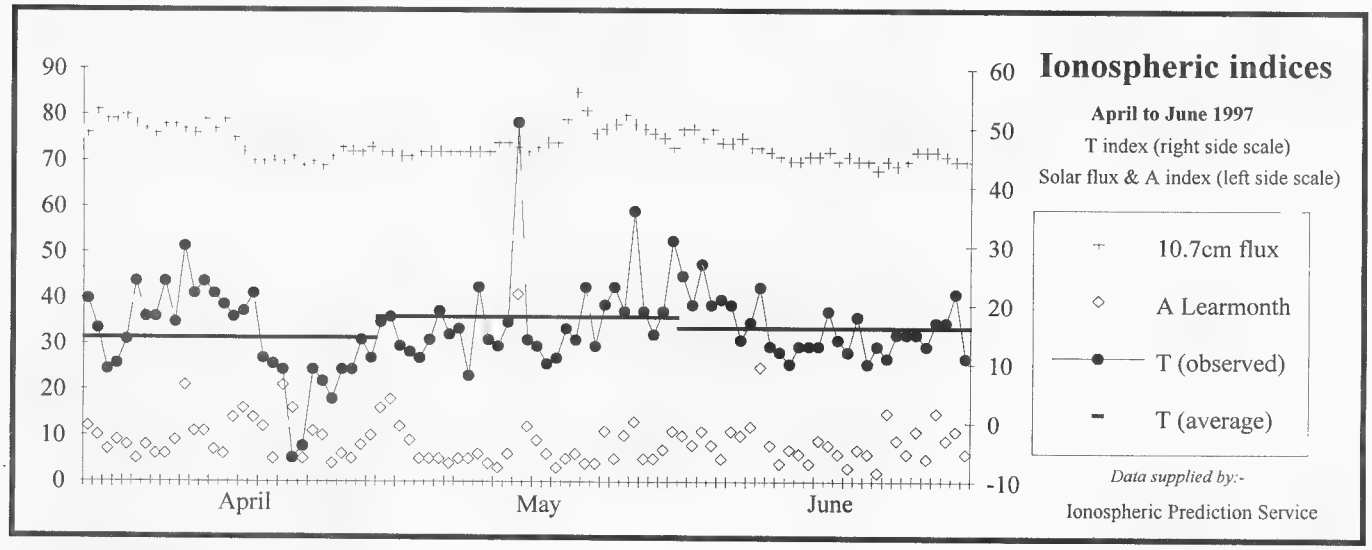
"The maximum phase of the cycle appeared to end rather abruptly in early 1992 when the monthly values of sunspot numbers dropped significantly. The decline of Cycle 22 to its minimum in May 1996 was also remarkable because of its lack of major flare activity. The cycle had a multiple personality - malevolent in its first half and quite benign in its decline. This contrasts with cycle 21 which was more active in its decline than during its rise or even its maximum. The cycle was less than 10 years in duration - a fair bit shorter than the "traditional" eleven year cycle.

"However, it is an interesting fact that all but one of the last seven cycles have been less than eleven years (Cycle 20 was the exception)."

A comparison graph overlaying the last four solar cycles shows how cycle 22 fared. The values used are running averages of five smoothed sunspot numbers (two preceding, two future and the current month). This crude filter removes minor perturbations but retains the shape of each solar cycle.

There were only three larger solar cycles (18, 19 and 21) and they were all exceptional.

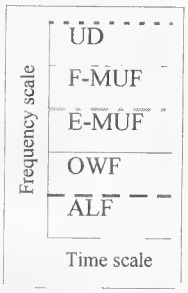
**C/o PO Box 2175, Caulfield Junction VIC 3161*



HF Predictions

Evan Jarman VK3ANI

T Index: 24



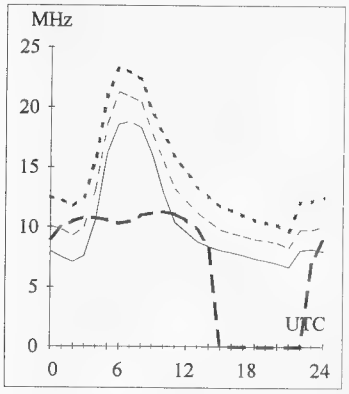
These graphs show the predicted diurnal variation of key frequencies for the nominated circuits. This also indicates a possibility of communication (percentage).

The frequencies, identified in the legend, are:-

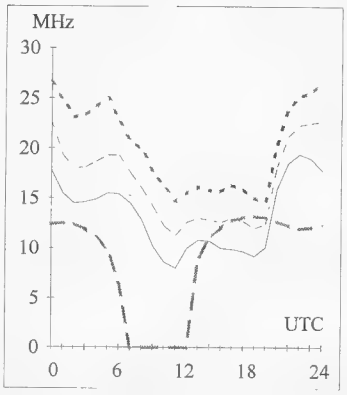
Upper Decile (F-layer, 10%)
F-layer Maximum Useable Frequency (50%)
E-layer Maximum Useable Frequency
Optimum Working Frequency (F-layer, 90%)
Absorption Limiting Frequency

The predictions were made with the Ionospheric Prediction Service program, ASAPS V3.2. The T index used is shown above the legend. The Australian terminal azimuth, path and propagation mode are also given for each circuit. **ar**

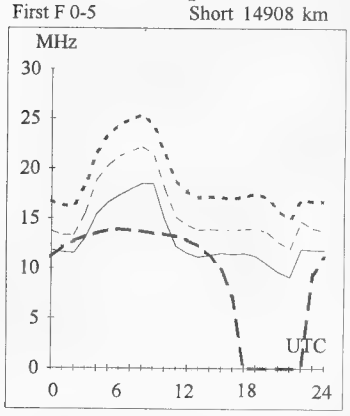
Adelaide-Botswana 236
Second 4F4-6 4E0 Short 10250 km



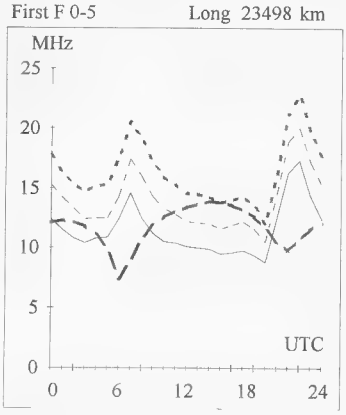
Brisbane-Lima 122
First F 0-5 Short 13056 km



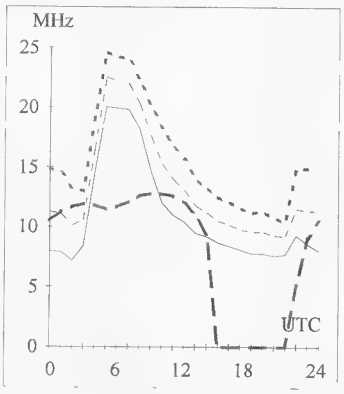
Adelaide-Budapest 305
First F 0-5 Short 14908 km



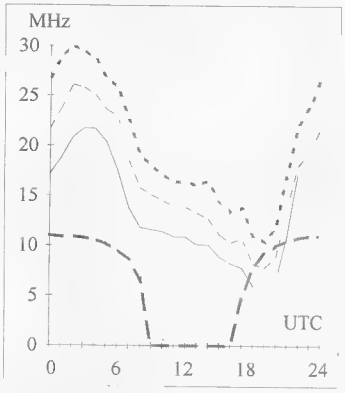
Brisbane-London 147
First F 0-5 Long 23498 km



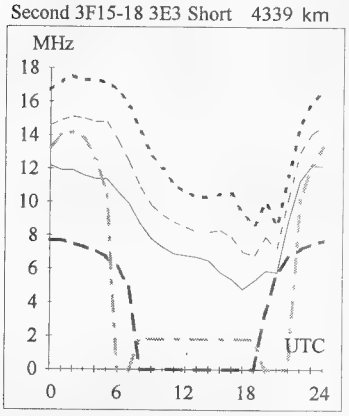
Canberra-Lusaka 239
Second 4F2-4 4E0 Short 11620 km



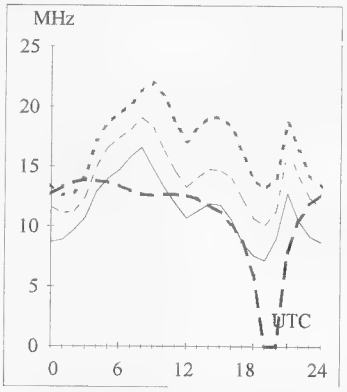
Darwin-Honolulu 65
Second 4F7-12 4E0 Short 8636 km



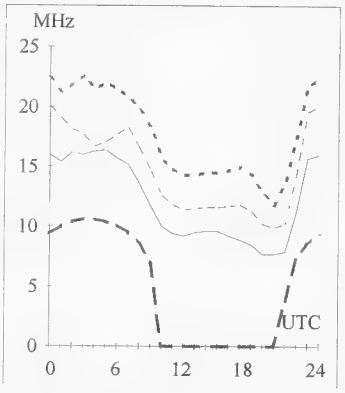
Adelaide-Suva 75
Second 3F15-18 3E3 Short 4339 km



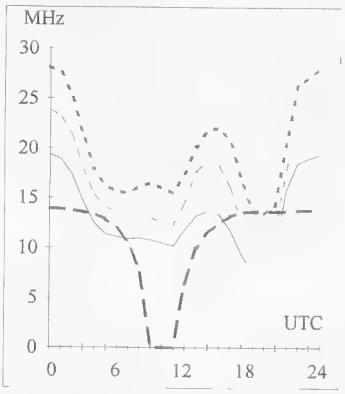
Brisbane-London 327
First F 0-5 Short 16526 km



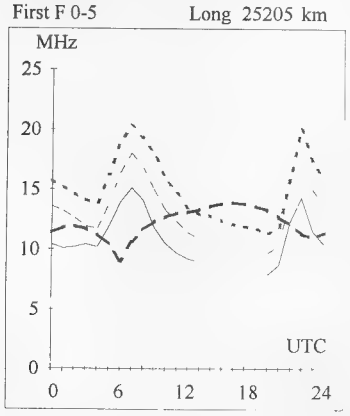
Canberra-Manila 327
Second 3F8-13 3E0 Short 6286 km



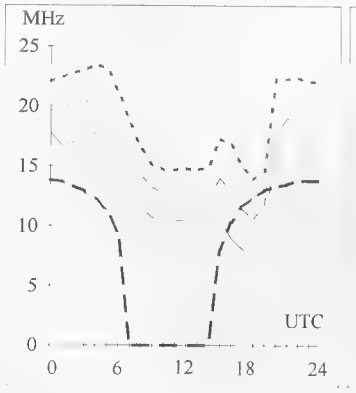
Darwin-Miami 61
First F 0-5 Short 16443 km



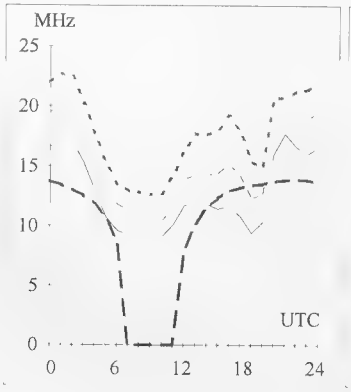
Adelaide-Warsaw 132
First F 0-5 Long 25205 km



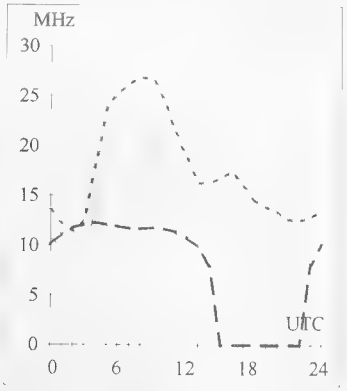
Brisbane-Seattle 44
Second 4F2-6 4E0 Short 11845 km



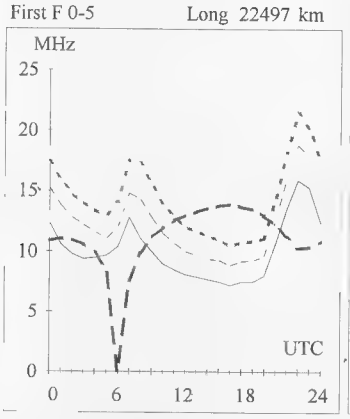
Canberra-Ottawa 59
First F 0-5 Short 16100 km



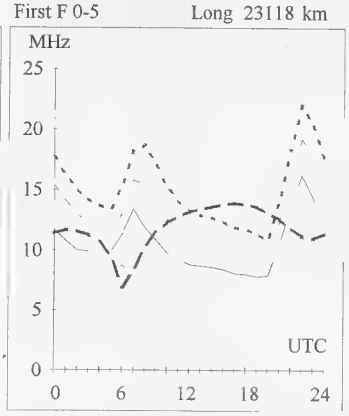
Darwin-Johannesburg 241
Second 4F4-6 4E0 Short 10639 km



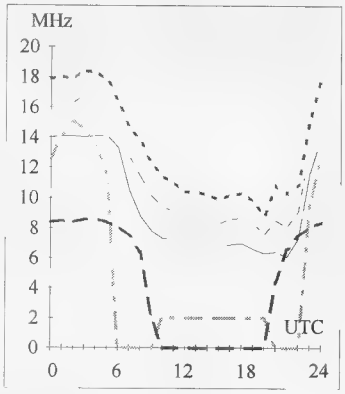
Hobart-Glasgow 135
First F 0-5 Long 22497 km



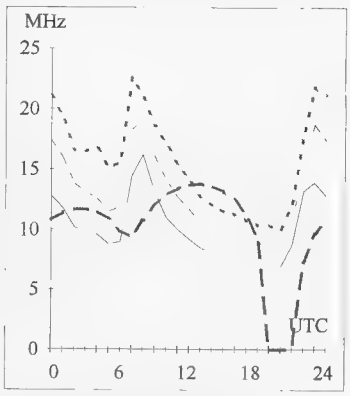
Melbourne-London 131
First F 0-5 Long 23118 km



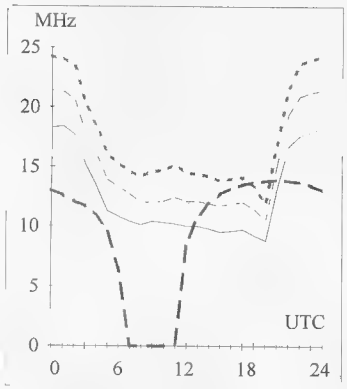
Perth-Auckland 113
Second 3F11-14 3E1 Short 5343 km



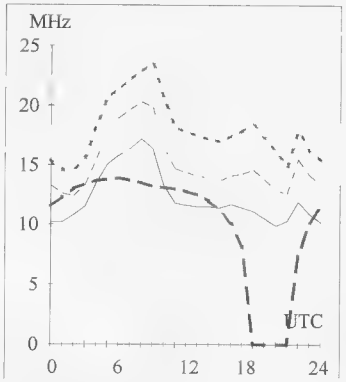
Sydney-Dakar 211
First F 0-5 Short 17589 km



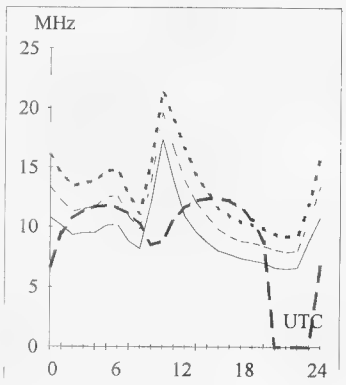
Hobart-New York 80
First F 0-5 Short 16610 km



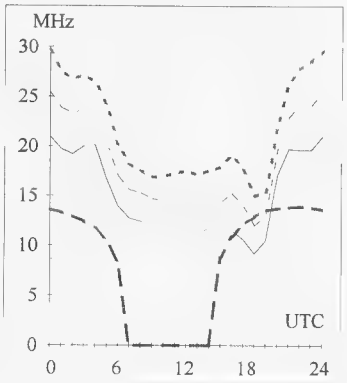
Melbourne-London 311
First F 0-5 Short 16906 km



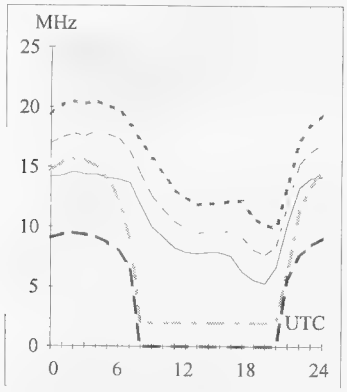
Perth-Rio de Janeiro 203
First F 0-5 Short 13523 km



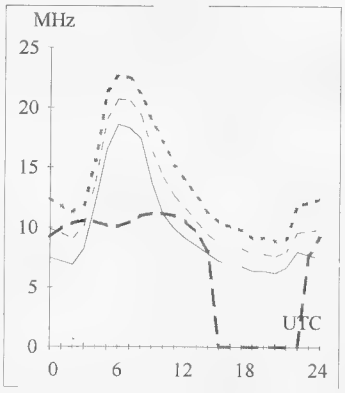
Sydney-Los Angeles 61
First F 0-5 Short 12075 km



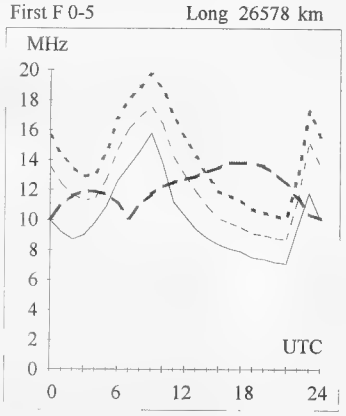
Hobart-Port Moresby 360
Second 2F10-13 2E1 Short 3711 km



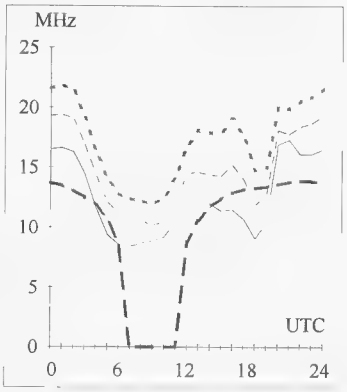
Melbourne-Pretoria 234
Second 4F4-6 4E0 Short 10352 km



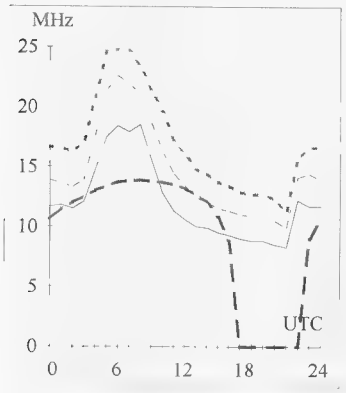
Perth-Stockholm 144
First F 0-5 Long 26578 km



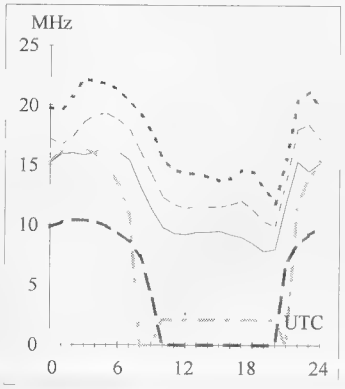
Sydney-Ontario 55
First F 0-5 Short 16197 km



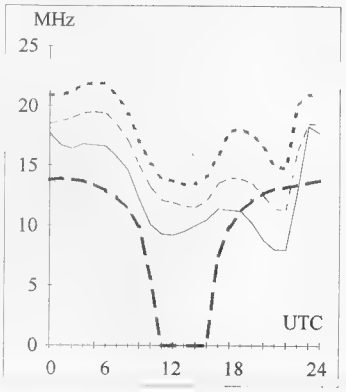
Hobart-Rome 284
First F 0-5 Short 16350 km



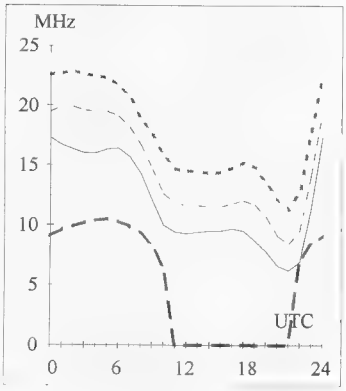
Melbourne-Tokyo 356
Second 4F8-13 4E0 Short 8192 km



Perth-Vancouver 50
First F 0-5 Short 14824 km



Sydney-Singapore 298
Second 3F8-11 3E0 Short 6295 km



HAMADS

- Hamads may be submitted on the form on the reverse side of the *Amateur Radio* address flysheet. Please use your latest flysheet where possible.
- Please submit separate forms for **For Sale** and **Wanted** items, and be sure to include your name, address and telephone number (including STD code) if you do not use the form on the back of the *Amateur Radio* address flysheet.
- Eight lines (forty words) per issue free to all WIA members, ninth and tenth lines for name and address. Commercial rates apply for non-members.
- Deceased estates Hamads will be published in full, even if the ad is not fully radio equipment.
- WIA policy recommends that the serial number of all equipment offered for sale should be included in the Hamad.
- QTHR means the address is correct in the current WIA Call Book.
- Ordinary Hamads from members who are deemed to be in general electronics retail and wholesale distributive trades should be certified as referring only to private articles not being re-sold for merchandising purposes.
- Commercial advertising (Trade Hamads) are pre-payable at $25.00 for four lines (twenty words), plus $2.25 per line (or part thereof), with a minimum charge of $25.00. Cheques are to be made out to: WIA Hamads.
- Copy should be typed or in block letters, and be received by the deadlines shown on page 1 of each issue of *Amateur Radio*, at:

  Postal: 3 Tamar Court, Mentone VIC 3194
  Fax: (03) 9584 8928
  E-mail: vk3br@c031.aone.net.au

TRADE ADS

• **AMIDON FERROMAGNETIC CORES**: For all RF applications. Send business size SASE for data/price to RJ & US Imports, PO Box 431, Kiama NSW 2533 (no enquiries at office please ... 14 Boanyo Ave Kiama). Agencies at: Webb Electronics, Albury: Assoc TV Service, Hobart: Truscotts Electronic World, Melbourne and Mildura: Alpha Tango Products, Perth: Haven Electronics, Nowra: and WIA Equipment Supplies, Adelaide.

• **WEATHER FAX programs** for IBM XT/ATs *** "RADFAXZ" $35.00, is a high resolution short-wave weather fax, Morse and RTTY receiving program. Suitable for CGA, EGA, VGA and Hercules cards (state which). Needs SSB HF radio and RADFAX decoder. *** "SATFAX" $45.00, is a NOAA, Meteor and GMS weather satellite picture receiving program. Needs EGA or VGA & WEATHER FAX PC card, + 137 MHz Receiver. *** "MAXISAT' $75.00 is similar to SATFAX but needs 2 MB of expanded memory (EMS 3.6 or 4.0) and 1024 x 768 SVGA card. All programs are on 5.25" or 3.5" disks (state which) plus documentation, add $3.00 postage. ONLY from M Delahuntly, 42 Villiers St, New Farm QLD 4005. Ph 07 358 2785.

• **HAM LOG v.3.1** – Acclaimed internationally as the best IBM logging program. Review samples....AR: "Recommend it to anyone": The Canadian Amateur: "Beyond this reviewer's ability to do it justice. I cannot find anything to improve on. A breakthrough of computer technology". ARA: "Brilliant". Simple to use with full help, the professional HAM LOG is immensely popular (now in its 5th year), with many useful, superb features. Just $59 (+ $5 P & P), with a 90 page manual. Special 5 hour Internet offer. Demos, brochures available. Robin Gandevia VK2VN, 02 369 2008 BH, fax 02 369 3069. Internet address rh@ozemail.com.au.

FOR SALE ACT

• **Log periodic antenna**, 8 el, 13-30 MHz, B Runnstrom VK1ABR, QTHR, 06 286 5652.

FOR SALE NSW

• **Vernus regulated 25 amp PSU**, 50% duty, 13.8 V, 2 separate outlets, 5 A metered 13.8 V, 1 x 32 V AC outlet unregulated, $125 ONO. **6 M vertical antenna** complete with loading coil, $30 ONO. Harry VK2MNZ, QTHR, 063 771 040.

• **Kenwood TS-440S**, auto ATU, general coverage Rx, VGC, s/n 9020751, original packaging, $1450 ONO. Paul VK2HV, 049 335 995.

• **Yaesu FT-101ZD**, VGC, new finals, mic, copy manuals, $500. VK2UJ, QTHR, 068 653 213.

• **Realistic HTX-100** 10 m SSB/CW 25 W txcvr, good condn, $140. Chris VK2YMW, QTHR, 02 9487 2764.

• **Cushcraft tri-band beam**, 10-15-20 m, with **Emotator rotator** and 7 metre mast with all guys and accessories ready to mount, plus 2 m 12 el antenna, everything in very good condn, the lot $500. Ernest VK2BED, 02 9532 0175.

• **Kenwood TS-430S**, mic, manuals, $950. **PS-430** 20 amp PSU, $350. **TR-8400** UHF txcvr, mic and manuals, $350. **Kenwood SM-220** station monitor with bandscope, $350. **Revex Wave monitor scope** with manual, $350. **Kenwood AT-200** ATU, $250. **Daiwa four-way coax switch**, $50. Drake low-pass filter, $50. John VK2FUR, 046 251 812.

• **Kenwood R1000** rcvr, s/n 0079614, good condn, instruction book, service manual, $200. VK2AVT, QTHR, 02 9580 4325.

• Deceased estate: **FT-767GX** HF, 6, 2 and 70 cm txcvr, desk mike, $2,900. **Alinco DJ120**, spkr mike, $225. **Yaesu FT-290R**, AC PSU, $300. **KP600 rotator**, $300. **Kenwood DS-900** 12 V – 240 V inverter, offers to VK2AYD, 065 85 2647.

• **Icom IC-490A** 70 cm multi-mode txcvr, s/n 04182, plus **Microwave Modules 70 cm 50 watt linear**, s/n L432/507792010, $550.00. **Gecol GV-16** 2 m h/held FM txcvr, s/n 000051, plus **Alinco 2 m 30 watt linear amp**, s/n 152101033, $150.00. Randall VK2EFA, QTHR, 08 8087 5285.

• Philips FM828 E Band with details and components (not xtals) for conversion to six metres, $50. W1Band, c/w speaker and mic, $40. David VK2BDT, QTHR, 048 215 036.

FOR SALE VIC

• **Plessey MTR-8000** 6 metre FM txcvr, 40 W output, 12 repeater channels, 12 simplex channels, remote head, hand mic and cables, $150. Ray VK3RD, 03 9726 9222.

• **Kenwood TM-241A** 144 MHz txcvr, s/n 20702418, c/w mounting bracket for mobile use, phones and manual, $490, negotiable. **Kenwood TS-520S** HF txcvr, s/n 810719, c/w phones, mic, manual, crystals on four ham bands, $450 negotiable.
Joe VK3DPB, 03 9306 9231.

• **Trio/Kenwood CS-1560A** 15 MHz dual trace oscilloscope, complete with probes and handbook, excellent condn, $385 ONO. **Akai 4000D** reel-to-reel tape recorder and quantity of tapes, excellent condn, $120 ONO. Ross VK3FCE, QTHR, 03 5442 8022.

• **Tektronix plug-ins** for 7000 series oscilloscopes. Wide range of **pre-amps and time bases** – 7A15, 7A16, 7A18, 7A24, 7B50, 7B53, 7B85 and more. Also HP, GR and Marconi and other **test equipment**. Prices from $40 to $150. All items VGC. Bob VK3BRF, QTHR, 03 9878 6613.

• Shack clear out – **Philips 815 and 814** (UHF are MK 1 & VHF MK 3) 50 watt base station transmitters, in-built 10 amp 13.8 volt power supply, $100.00 each. **LDF4/50 heliax cable** (1.42 dB attenuation/100 ft at 400 MHz), length approximately 25 metres with terminated type N male and female connectors, $125.00. **Rangemasters converted to 6 metres FM**, one with repeater VK3RMS and 53.5 MHz simplex, the other with repeater VK3RMS only, units physically small, with internal speaker, Tx power 25 watts, $60.00 and $45.00 respectively, ONO. **Icom 551D** 6 metre all mode 8O watt, with FM board, $550.00. **160 metre AM transmitter**, de-rated to 150 watts, has broadcast specs, complete with audio mixer, limiting amp, modulation monitors and dummy load, $300.00, ONO. Military Radio Collectors Items: **AT5/AR8** combination transmitter receiver with AC type S power supply and cables, handbook, $320.00, ONO; **No 19 set** complete with handbook and spare chassis, $250.00, ONO; **No 22 set**,

complete, $250.00, ONO; **AR7 receiver**, unmodified, in mint condition, complete with handbook, $200.00. Ian VK3AYK, 03 9585 1123 AH.

• **Icom IC-725** HF txcvr, EC, $995. **Icom IC-706**, all HF bands plus 6 and 2 m txcvr, EC, $1650. Bill VK3WK, QTHR, 03 5561 1376.

• **IC-271A** 2 m all mode txcvr, internal PSU, $850. **FM-321** 80 channel 70 cm, $150. **TS-430S**, $850. **IC-2GAT**, carry case, $280. **FT-209RH**, $220. **FT-209R**, $150. **FT-23**, carry case, $190. **IC-2SAT**, ext Rx, $220. **BC-36** charger, $95. **FT-101ZD**, $600. **FC-901** 500 W ATU, $250. **FV-101DM** digital ext VFO, $190. **FT-223** 2 m FM mobile, rpt 2-8, chan 50/54, $95. **FM-92R** 70 cm, 99 chan, $275. Lee VK3GK, QTHR, 03 9544 7368 or 015 810 101.

• **Icom IC22S** 2 m txcvr, complete with manuals, circuits, mobile bracket, original packing, etc, plus external switching system to get any frequency from 144 up, working at the moment, $150. **PacComm Tiny-2** packet modem, complete with instruction manuals, computer lead, original packing, little used, $200. **Topward Model TFC 1207** frequency counter, range 10 Hz to 1 GHz, complete with instruction manual and leads, EC, $200. **Logitech ScanMan 256** hand scanner, B&W, for Windows 3.1 and 95, as new with all hardware and software, original packing, had very little use, $75. **ATN log periodic 8 el beam**, GC, see/hear working, 14 – 30 MHz cont, $400. Bob VK3AQK, QTHR, 03 5744 1676.

• **Icom IC-471H** UHF all mode txcvr, s/n 03154, 13.8 V DC 75 W, unmodified, VGC, $1160. Des VK3CY, QTHR, 03 5494 3156.

• **Alinco DR-599** 2 m/70 cm 50 W mobile txcvr, CTCSS/DTMF, as new, $720. **Handi-Packet portable TNC**, $150. **Tiny-2 TNC**, $80. **DRSI packet computer card**, $95. **Tokyo Hy-Power HL-62V** 2 m 50 W amplifier with Rx pre-amp, as new, $85. Kevin VK3ASM, QTHR, 03 9874 2046.

• **Kenwood AT-250** auto ATU, 160-10 m, as new, boxed, $200. **Kenwood PS-30** 20 A PSU, as new, boxed, $175. **Terlin Outbacker** type mobile whip, 80-10 m and some RFDS frequencies, with matching HD spring base, $150. **Mirage 80 W 2 m amp** with Rx pre-amp, $125. Ron VK3OM, QTHR, 03 5944 3019.

• **Icom IC-701** solid state 100 W txcvr with desk mic, GC, $375 ONO. Bill VK3DQS, QTHR, 03 9791 2947.

• **Kenwood TS-820S** HF txcvr, s/n 740961, excellent condn, overhauled by Kenwood in Sydney, mic, ext spkr, manual, DC converter, $450 the lot, ONO. Gordon VK3ABI, QTHR, 03 5289 1812.

• **Two bedroom house**, Frankston South, well maintained, ducted heating/air conditioning throughout, land 800 sq metres, two street entrances, ideal ham site, includes Nally tower, TH6DXX, Council approved three unit site, $129,000 ONO. VK3CLV, QTHR, 03 9787 4915.

FOR SALE QLD

• **Yaesu FT1** txcvr, s/n 060010, passed OK by DSE, $625, buyer collects. **Yaesu FT7** HF txcvr, s/n 090745, $300. Yaesu HF whips with 2 m stub and gutter mount, $90. VK4KD, QTHR.

• **Radiotron Designer's Handbook** 4th edition 1955, $40. **Henney Radio Engineering Handbook**, 3rd edition 1941, $25. **Earth strap**, heavy copper braid inch wide, $2 per metre. Peter VK4APD, QTHR, 07 3397 3751 AH.

FOR SALE SA

• **Yaesu Musen FV-101** remote VFO for FT-101B, $100. **Icom IC-551** 50 MHz transceiver fitted with FM and IF bandpass modules, $500. **GME Electrophone Model TX475S** hand-held UHF 40 channel FM transceiver, $250. **KLM PA 10 160LB** 160 watt 144 MHz amplifier, $350. **Lunar ML432/50** 432 MHz amplifier with pre-amp, $300. **MFJ-752** Signal Enhancer, $200. **Rustrak 88** chart recorder, $80. **Model 837-7 decibel meter** in fine wooden case, $70. **Lunar PAG** 432 MHz pre-amp, $150. **Lunar 6M3-50P** 50 watts 50 MHz amplifier, $200. **MFJ six position switched attenuator**, suit EME station, $150. **Speech processor**, $40. **Air blowers**, two large, $40 each. Set of five **mobile whips** for HF bands (will not split), $120. Everything in very good condition. Eric VK5LP, QTHR, 08 8575 1531 (not able to answer before 0000 UTC), e-mail *vk5lp@ozemail.com.au*

• Yaesu FT-707 HF mobile or base station txcvr, s/n 0K101217, mic, manual, etc, $550 ONO, will deliver anywhere (if you don't know this txcvr, will send copy of review to you). David VK5AXW, 08 8370 1066 BH, or 08 8370 9569 AH.

FOR SALE WA

• **QTH**, 3 bedroom, lockup garage, shack, Council approved mast, coastal location 65 km north of Perth, $97500. David VK6ADP, 4 Dawes Court, Two Rocks, WA 6037, 08 9561 1865.

• **Kenwood TL-922** 1 kW linear amplifier, recent 3-500ZGs and spare pair, $2100. Phil VK6APH, 08 9245 2973.

WANTED ACT

• **Bird Model 43** or similar thru line power meter. VK1BUC, QTHR, 062 916 187 (AH) or 062 613 019 (BH).

WANTED NSW

• **Philips FM920** W1 or U band radio for modification to 70 cm. Garry VK2TSR, 02 9631 9005 (Bus).

• **70 cm or dual-band SSB txcvr**, AC powered, eg Kenwood TS-780 or similar. What offers? Gordon VK2ZAB, QTHR, phone of fax 02 9456 4163.

• Xerox of the **Quick Reference instructions for a Mark II Avo valve tester**. Ben Furby VK2XNZ, QTHR, 02 9787 1353.

• **Yaesu FL-2100B or FL-2100Z** linear amplifier, must be VGC, prefer VK2 area but others considered. Paul VK2HV, 049 335 995.

• **Bird Thruline wattmeter model 43**, in good order, preferably with plug-in sensor elements for 144, 432 and 1296 MHz. Guy VK2BBF, QTHR, 047 516 726

• **Resonators for Scalar Trident** mobile whip, 20 and 15 m. VK2ASI, QTHR, 067 657 947.

WANTED VIC

• **AR7 communications receiver,** in any condn, and any spare coil boxes. Howard, 03 9408 7597.

• **Icom filters**, FL-223 1.9 kHz, FL-52A 500 Hz, and FL-53A 250 Hz.

Adam VK3ALM, QTHR, 03 9794 7873, e-mail: *adam@rint.com.au*

WANTED QLD

• **RCA Receiving Tube Manual**, RC28 1970/1. Peter VK4APD, QTHR, 07 3397 3751.

WANTED WA

• **3-500Z tubes and chimney**. HV filter capacitors. Henry VK6HJT, 08 9426 5809 (AH).

MISCELLANEOUS

The WIA QSL Collection (now Federal) requires **QSLs**. All types welcome, especially rare DX pictorial cards, special issue. Please contact the Hon Curator, Ken Matchett VK3TL, 4 Sunrise Hill Road, Montrose VIC 3765, tel 03 9728 5350.

ar

QSP News

Honorary Life Membership for Gary Herden VK5ZK

At the June General meeting of the VK5 Division, members voted unanimously to confer Honorary Life membership of the Division upon Gary VK5ZK.

Gary Herden has, over the years, made a major contribution to the cause of amateur radio. I believe that he has held his licence for something in the order of 35 years. He has served on the VK5 Council for at least 11 years and held office as Divisional President for two terms as well as the consequent two years as Immediate Past President.

Amongst the many things which Gary has done in contributing to the hobby are originating the Sunday broadcast from his own home in the 1960s era, co-ordinating the construction and installation of the original Adelaide two metre repeater at Crafers, being involved in many facets of development of the packet radio system in South Australia, providing satellite gateway facilities from his home station, serving as chairman on a variety of committees including the SA Technical Advisory Committee and SAPUG, acting as an OSCAR co-ordinator, being on the Sunday broadcast operators' roster, and providing liaison with the SMA on behalf of the Amateur Radio operators of South Australia. He was also involved in many hours of work during the period of conversion of the old Thebarton Council "incinerator" into what is now our Divisional Headquarters, the Burley Griffin Building.

There can be no doubt whatsoever that Gary has certainly more than earned the privilege of Life Membership. Congratulations are extended to Gary on behalf of all amateur radio operators and the many others of his friends. It is intended that a suitable presentation will be made to Gary at the July General meeting of the Division. **(information from Ian J Hunt VK5QX, VK5 Division President)**

WIA Divisions

The WIA consists of seven autonomous State Divisions. Each member of the WIA is a member of a Division, usually in their residential State or Territory, and each Division looks after amateur radio affairs within its area.

	Division Address	Officers			Weekly News Broadcasts		1997 Fees
VK1	ACT Division GPO Box 600 Canberra ACT 2601	President Secretary Treasurer	Hugh Blemings John Woolner Les Davey	VK1YYZ VK1ET VK1LD	3.570 MHz LSB, 146.950 MHz FM each Sunday evening commencing at 8.00 pm local time. The broadcast text is available on packet, on Internet aus.radio.amateur.misc newsgroup, and on the VK1 Home Page http://www.vk1.wia.ampr.org	(F) (G) (S) (X)	$72.00 $58.00 $44.00
VK2	NSW Division 109 Wigram St Parramatta NSW (PO Box 1066 Parramatta 2124) Phone 02 9689 2417 Freecall 1800 817 644 Fax 02 9633 1525	President Secretary Treasurer (Office hours Web:http://marconi.mpce.mq.edu.au/wia e-mail address: wiansw@sydney.dialix.oz.au Packet BBS: VK2WI on 144.850 MHz	Geoff McGrorey-Clark Eric Fossey Eric Van De Weyer Mon-Fri 11.00-14.00)	VK2EO VK2EFY VK2KUR	From VK2WI 1.845, 3.595, 7.146*, 10.125, 14.160, 24.950, 28.320, 29.120, 52.120, 52.525, 144.150, 147.000, 438.525, 1281.750 (* morning only) with relays to some of 18.120, 21.170, 584.750 ATV sound. Many country regions relay on 2 m or 70 cm repeaters. Sunday 1000 and 1930. Highlights included in VK2AWX Newcastle news, Monday 1930 on 3.593 plus 10 m, 2 m, 70 cm, 23 cm. The broadcast text is available on the Internet newsgroup *aus.radio.amateur.misc*, and on packet radio.	(F) (G) (S) (X)	$69.00 $56.00 $41.00
VK3	Victorian Division 40G Victory Boulevard Ashburton VIC 3147 Phone 03 9885 9261 Fax 03 9885 9298	President Secretary Treasurer (Office hours Tue & Thur 0830-1530) Web: http//www.tbsa.com.au/~wiavic/	Jim Linton Barry Wilton Rob Hailey	VK3PC VK3XV VK3NC	VK3BWI broadcasts on the 1st Sunday of the month, starts 10.30 am. Primary frequencies 1.840 AM, 3.615 LSB, 7.085 LSB, and FM(R)s 146.700 Mt Dandenong, 147.250 Mt Macedon, 147.225 Mt Baw Baw, and 2 m FM(R)s VK3RMA, VK3RSH and VK3ROW. 70 cm FM(R)s VK3ROU and VK3RGL. Major news under call VK3WI on Victorian packet BBS.	(F) (G) (S) (X)	$75.00 $61.00 $47.00
VK4	Queensland Division GPO Box 638 Brisbane QLD 4001 Phone 074 96 4714	President Secretary Treasurer e-mail address: wiaq@brisbane.dialix.com.au	Rodger Bingham Malcolm McIntosh Bill Sebbens	VK4HD VK4ZMM VK4XZ	1.825 MHz SSB, 3.605 MHz SSB, 7.118 MHz SSB, 14.342 MHz SSB, 28.400 MHz SSB, 29.220 MHz FM, 52.525 MHz FM, 146.700 MHz FM, 147.000 MHz FM, 438.525 MHz (Brisbane only), regional VHF/UHF repeaters at 0900 hrs Sunday. Repeated on 3.605 MHz SSB & 147.000 MHz FM, regional VHF/UHF repeaters at 1930 hrs EAST Monday. Broadcast news in text form on packet under WIAQ@VKNET.	(F) (G) (S) (X)	$74.00 $60.00 $46.00
VK5	South Australian Division 34 West Thebarton Rd Thebarton SA 5031 (GPO Box 1234 Adelaide SA 5001) Phone 08 8352 3428 Fax 08 8264 0463	President Secretary Treasurer Web: http://www.vk5wia.ampr.org/	Ian Hunt Graham Wiseman Joe Burford	VK5QX VK5EU VK5UJ	1827 kHz AM, 3.550 MHz LSB, 7.095 AM, 14.175 USB, 28.470 USB, 53.100 FM, 147.000 FM Adelaide, 146.700 FM Mid North, 146.800 FM Mildura, 146.825 FM Barossa Valley, 146.900 FM South East, 146.925 FM Central North, 147.825 FM Gawler, 438.425 FM Barossa Valley, 438.475 FM Adelaide North, ATV Ch 35 579.250 Adelaide. (NT) 3.555 USB, 7.065 USB, 10.125 USB, 146.700 FM, 0900 hrs Sunday. 3.585 MHz and 146.675 MHZ FM Adelaide, 1930 hrs Monday.	(F) (G) (S) (X)	$75.00 $61.00 $47.00
VK6	West Australian Division PO Box 10 West Perth WA 6872 Phone 09 351 8873	President Secretary Treasurer	Wally Howse Christine Bastin Bruce Hedland-Thomas	VK6KZ VK6ZLZ VK6OO	146.700 FM(R) Perth, at 0930 hrs Sunday, relayed on 1.825, 3.560, 7.075, 14.116, 14.175, 21.185, 29.680 FM, 50.150 and 438.525 MHz. Country relays 3.582, 147.350(R) Busselton and 146.900(R) Mt William (Bunbury). Broadcast repeated on 146.700 at 1900 hrs Sunday, relayed on 1.865, 3.563 and 438.525 MHz; country relays on 146.350 and 146.900 MHz.	(F) (G) (S) (X)	$62.00 $50.00 $34.00
VK7	Tasmanian Division PO Box 271 Riverside TAS 7250 Phone 03 6327 2096 Fax 03 6327 1738	President Secretary Treasurer	Ron Churcher Barry Hill Mike Jenner	VK7RN VK7BE VK7FB	146.700 MHz FM (VK7RHT) at 0930 hrs Sunday relayed on 147.000 (VK7RAA), 146.725 (VK7RNE), 146.625 (VK7RMD), 3.570, 7.090, 14.130, 52.100, 144.150 (Hobart) Repeated Tues 3.590 at 1930 hrs.	(F) (G) (S) (X)	$74.00 $60.00 $46.00
VK8	(Northern Territory is part of the VK5 Division and relays broadcasts from VK5 as shown received on 14 or 28 MHz).						

Note: All times are local. All frequencies MHz.

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